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### *The Antiseptic Treatment of Timber.*

THERE can be but two opinions as to the growing importance of studying the question of timber preservation, having regard more particularly to the reckless manner in which our own forests have disappeared and the little care that is bestowed on the forests of our colonies and the United States,—forests as yet of vast area, but nevertheless thinning so rapidly as to be palpable to the most casual observer. It is true that the substitution of iron and steel for wood in the navies of the world has largely diminished the call for timber in that direction, but this diminution is made up for by the enormous extension of the railway system and the demand for sleepers and telegraph-poles, as also for the piles necessary for the great harbour and reclamation works that are so numerous at the present day. Any information concerning the practical preservation of wood is, therefore, of extreme value, and Mr. Boulton's pamphlet* (the result of a paper read last autumn before the Institution of Civil Engineers) is one which deserves careful study.

The appearance, on a large scale, of the dry rot in the ships of the British Navy, at a time when they really were the wooden walls of old England, was naturally a subject of considerable alarm, when we know that a single seventy-gun ship required for its construction the oaks of forty acres of forest, and, therefore, it was not to be wondered at, that, as early as the beginning of this century, various proposals were made to stem the evil by the use of various salts of metals. The inquiry assumed more definite proportions, however, when the railway era was fairly inaugurated, and it was found that stone sleepers were too rigid to be useful; and several materials were experimented upon for timber preservation with more or less success. The first system of treatment was called Kyanising, after its inventor, Mr. Kyan, and consisted of the use of corrosive sublimate. It answered the purpose very fairly, especially when the timber was in a dry situation, though it failed when tried under water, and particularly under sea water. Moreover, corrosive sublimate was found to be rather too volatile at ordinary temperatures, and to be injurious to those who had to handle it. Margarising, the system adopted by Mr. Margary, was the employment of the sulphate of copper, which appears to be the most reliable of all the metallic salts, and is still in use in France. Burnettising (after Sir William Burnett) was the adoption of chloride of zinc, a good timber antiseptic, but very soluble in water. It is still in favour in Germany and Holland. Finally came Mr. Bethell's celebrated patent for creosoting,—a bad name for the existing process by coal tar, as in reality creosote is a product of the destructive distillation of wood, which has never been used for timber preservation; and the only excuse (a very far-fetched one) for the name was because somebody discovered carbolic acid or phenol in both coal-tar and wood distillation. "There is a river in Macedon and a river at Monmouth, and there be salmons in both"; so that it must be understood that creosote, in its popular application to wood-preserving, is not creosote, but oil of tar.

The basis of the action of all these remedies was supposed to be that they coagulated the albumen of the sap, and formed insoluble compounds that arrested decay; but as it has been proved by experience that the salts of metals are not so efficacious or so permanent as the tar-oils, the so-called creosoting process has now for a considerable period outlived its competitors. Even in France, where the sulphate of copper has held its own longer than anywhere else, partly because there was a difficulty of getting the creosote, partly because Dr. Boucherie injected the sulphate in a peculiarly ingenious manner, and partly because it was noted that the salts of metals became washed out in damp situations, even there the creosoting process has met with great approbation, since Mr. Forestiere observed how thoroughly the timber was protected against that most troublesome pest, the *Teredo navalis*. The oil used in creosoting is thus prepared. When coal is carbonised for gas-making, the products given off are four, viz., illuminating gas, ammoniacal or gas liquor, coal-tar, and coke,—all of them, in their several ways, of extraordinary commercial value, though, in the present case, the coal tar, a black treacly-looking substance, is all that we have to deal with. It may be mentioned, however, incidentally, that the waste or gas-liquor is the parent whence the ammonia group is manufactured on a large scale. By distilling the coal tar, three separate groups of products are obtained:—first, the oils which are lighter than water, such as the naphthas, which are of incalculable importance to the country, as from them are ultimately procured the aniline dyes; secondly, the oils which are heavier than water; and, thirdly, the pitch, which is the residuum of the distillation. The lighter oils form a category of themselves quite distinct from the heavier ones, and have never been used for creosoting purposes; but they are extremely rich in their own particular constituents, yielding, amongst other results, the benzoles from which the aniline is obtained, the toluols, the solvent and burning naphthas, and carbolic acid, whence is derived the picric acid, used for fulminating purposes. The heavy or "dead" oils form the creosote of the timber-yard, and they were formerly treated *en masse*, though now each constituent can be separately removed according to its volatility. These dead oils are divided by the trade into two kinds,—"London" and "country,"—the former being the distillation from the best Newcastle coals, which are usually supplied to the South of England, and are much richer than other coals in semi-solid substances, such as anthracene, naphthalene, &c. The country oils, on the other hand, are distilled from the Midland coals, and are more volatile, besides containing a larger proportion of tar acids. In the earlier days of Bethell's patent, the heavy or dead oils were alone used, it being considered that the crude naphthas were useless as antiseptics, and that the pitch, from its solidity, would form an impediment to the injection; but the fashion gradually came into use of mixing a small percentage of country with the London oils, as diluents of the more solid material; and, in point of fact, the country oils became popular and mentioned in specifications.

The inspectors liked them, because they were thinner and injected with less trouble, and also because the timber thus treated looked cleaner and less muddy. The late Dr. Letheby, too, gave a great impetus to the growing use of the country oils, as he considered that the carbolic acid (which had been discovered in coal tar by Runge in 1834) was the key of the whole position, and that the efficacy of the treatment consisted in the percentage of carbolic acid. It was his object, therefore, to exclude the naphthalene and para-naphthalene as of no value, but to include the lighter portions of the oils, viz., those which distilled between 360° and 490° Fahr., as containing the tar acids in the greatest abundance. Here again, incidentally, we may mention that this para-naphthalene, useless in timber preserving, has been found to ultimately yield anthracene, the parent of alizarine, that beautiful red dye, that has so completely superseded madder in textile operations.

Dr. Letheby, however, did not have it all his own way, for the investigations of De Gemini and Rottier, in France, and of M. Coisne, in Belgium, seemed to entirely disprove his conclusions. The latter gentleman an engineer in the service of the Belgian Government, placed shavings in a putrefying

* Boulton on "The Antiseptic Treatment of Timber."

pit for four years, saturated with creosote containing respectively 15 per cent., 8 per cent., and 7 per cent. of tar acid, while one sample was of heavy specific gravity, and held no tar acid whatever. This last experiment, however, was the most successful of all, and throughout the whole series it was evident that the results were in favour of the heavy oils, and that the tar acids were of no use at all. The Belgian Government accepted M. Coisne's statement, and does not stipulate, in its railway specifications, for any tar acids, though it allows 30 per cent. of naphthalene, one of the very substances discarded by Dr. Letheby. Following an inverse method of examination, M. Coisne procured and analysed some creosoted sleepers that had resisted decay for twenty years, and he found no tar acids, but, on the contrary, plenty of naphthalene. Similar experiments were undertaken by Mr. Boulton, in 1882, on sleepers from various railways which had been in use for from sixteen to thirty-two years, and his analysis proved four things: — 1. That no tar acids were detected by the ordinary methods. 2. In the majority of cases the semi-solid constituents, such as naphthalene, were present. 3. Only small percentages remained of oils distilling below 450° Fahr.: all these facts proving that it was through the action of the heaviest and most solid portions of the oils that the preservation was effected. 4. He detected an alkaloid called acridine, which, he thought, played an important part in the action, it being undoubtedly a powerful germicide and solidifying within the pores of the timber, without evaporating or being washed out. Mr. Greville Williams also came to the conclusion that the antiseptic results of creosote were due more to the basis of alkaloids than to the tar acids, the former remaining while the latter seem to disappear. It is, therefore, most probable that it is this unfortunate quality of evaporation that disqualifies the tar acids, seeing that, taken *per se*, there is no doubt but that these acids are powerful antiseptics, and that their presence arrests decay. Mr. Boulton's experiments show that if tar acids and naphthalene be separately exposed at the same temperatures, the former will evaporate much more quickly than the latter; indeed, by repeated washings with cold water, both carbolic acid and cresylic acid (its near relation and a constituent of tar oil) can be completely disposed of, a most important fact in connexion with the exposure of timber to sea-water.

Viewing all these facts in their bearings upon specifications, it would seem as if the London oils, as they come from the still, are not sufficiently volatile, nor do they comply with the requirement as regards the percentage of tar acids. A pressure is, therefore, put upon the manufacturer to meet the case by taking out some of the heavier portions, by which the bulk is rendered lighter and the proportion of the tar acids to the diminished bulk is increased. But Mr. Boulton considers that this is a mistake, and would rather relegate the lighter portions of the tar acids, and especially carbolic acid, to their proper position as sanitary antiseptics, for which they are unrivalled, and would encourage the use of the heavier portions. He also agrees with the joint creosoting specification of Sir Frederick Abel and Dr. Tidy, who resolved to exclude no semi-solid bodies which completely melt at 100° Fahr., and further changed the standard of volatility from 90 per cent. at 600° Fahr. to 75 per cent.

Without going into the vexed regions as to the exact relations of putrefaction and the germ theory, the conclusions drawn are,—that the best antiseptics for timber are to be found amongst oils and bitumens, which fill up the pores of the wood. Of such bodies, those that contain germicides are to be preferred, and, other properties being equal, those which either solidify in the pores of the wood, or which require an extremely high temperature to volatilise them, and which are insoluble in water, are the best of all. With regard to the creosoting process, Mr. Boulton lays great stress on the hygrometric condition of the timber at the time of injection, neglect of which has often been the cause of failure. The power of absorption of moisture in woody fibres is so great,—fir timber being able to take up as much as from 60 to 150 gallons of water to the load of 50 cubic feet,—that it has always proved a great difficulty in the way of treatment, as the subjecting of the timber to a dry heat invariably results in injury to it. Mr. Boulton has, however, successfully met the difficulty by a most ingenious combination of air-pump action with the use of creosote heated up to 212° Fahr. With charges of very wet sleepers, he has withdrawn water equal in volume to 50 gallons per load of timber, the water being replaced with an equal volume of creosote by the action of the air-pump alone.

## THE RELATION OF THE COLOUR-SENSE TO ART.

BY CHARLES ROBERTS, F.R.C.S.

OUR short English proverb "Tastes differ," which often winds up a discussion on æsthetic subjects, assumes a somewhat wider form among the French, and is to the effect that it is useless to dispute about questions of taste and colour. One of the chief reasons for differences of opinion is that, although taste and colour are at bottom mental conceptions, people do not see their physical incidents with the same eyes. Take the case of the beauty of the human form, for instance. A short-sighted person sees only an average of the most conspicuous features in the hazy condition of one of Mr. F. Galton's compound photographs, while an acute-sighted person detects all their minute imperfections: hence the openings for a long discussion on personal beauty. With regard to colour the opportunities for disagreement are still larger, as the variations of the colour-sense in different individuals are greater and of a more subtle kind than those of the refraction of the structures of the eyeball. There are, for instance, a few persons in the world (two of whom have come under my own notice), who can form no notion of colours except as mere shades of black and white. There are others, again, whose scale of colour is deficient in one of its fundamental elements, and not only does the red, or the green, or the violet, as the case may be, disappear in its true form and in its various combinations, but the elements which do remain produce colour-scales entirely different from our own. Further, there is a condition of the colour-sense which, although recognising all the colours of the spectrum in their purer and more intense forms, is quite unequal to distinguishing the lighter shades one from another, or greens from various forms of grey and the dull tints which are affected by many æsthetes of the present day. Finally, there is a considerable variation in the fine appreciation of shades of colours among persons who possess a good colour-sense, so that no one should venture to criticise, much less to ridicule, another person's colouring, until his own colour-sense has been proved to be good by a proper scientific examination. It is, indeed, very probable that the colour-sense varies as much in different persons as does any other physical quality of the body,—the stature, for example,—and that not only are there giants and dwarfs, so to speak, of colour-perception, but the intermediate stages are grouped, according to the theory of probabilities, increasing from a minimum of complete colour-blindness in larger and larger numbers to an average colour-sense, and diminishing from the average to a maximum of the higher colour perception, the groups forming the usual binomial curve.

The more decided forms of colour-blindness are easily detected by several well-known methods of procedure, and the finer differences by an instrument devised by Lord Rayleigh for demonstrating the truth of what many artists are slow to believe, that yellow is a compound colour composed of red and green light. The instrument consists of an arrangement to superimpose red and green light upon each other in different proportions, together with a pure yellow light as a test colour. It is in the efforts to produce a match to the test colour that the quality of the colour-sense of different persons is proved. Some persons require a larger amount of red light than others to neutralise the green, or, on the other hand, more green light than red, so that to some persons the spectrum yellow is almost orange, while it is pale green to others. Here, again, we have the observations forming a binomial curve between the extremes of orange and pea green, pure yellow being the average of all the observations. A similar variation occurs, no doubt, with all the other colours of the spectrum.

It might be thought that persons who are colour-blind, or who labour from any deficiency of the colour-sense, would take little interest in either the practice or the enjoyment of art, as colour forms so large and important an element in most artistic productions. Yet this is far from being the case. Not only do many persons so affected take a great interest in pictures, and endeavour to paint them, but, strange to say, it is in the region of art as engravers, &c., that such persons have found a profitable and enjoyable occupation. Many persons first learn of the existence of their chromatic defect by the artistic instinct endeavouring to assert itself, and when failure is the result much ingenuity is displayed in overcoming the impediment. Professor Wilson records the case of a gentleman who was a skilful draughtsman who in early life discovered his inability to arrange his own palette, and was accustomed to rely on a relative to select his colours, which he had then no difficulty in using, or mixing to the shades he required. This person's account of his colour-sensations is very instructive, because as an educated man he appears to have made himself familiar with the names of many colours and shades of colours which are not commonly recognised by persons with a good colour-sense. It must not be inferred, however, that a person who applies the proper names to colours is not colour-blind, as the names may have been learned from other characters than their colour; and, on the other hand, a person may be ignorant of the names of colours and yet possess a perfect chromatic sense. The vagueness of the language employed by colour-blind persons shows also that there is no distinct line drawn between a good and an imperfect colour-sense, as is popularly supposed. The gentleman I have referred to could distinguish the orange, yellow, and blue in the rainbow, but he could not see the green, and he was very uncertain about the red. On one occasion he was surprised to find that a letter he had written home during his absence was half in black and the other half in red ink. Red cabbage, growing or in infusion, were of the most beautiful blue to him, and it was by not observing any change by acids in the infusion when attending Professor Hope's chemistry class, when he used to stare for the whole hour expecting to see a change, that he became fully convinced of his defect. Red (pink) in the lips, cheeks, or nose appeared blue to him; and pinks, lilacs, purples, and blues were the same colour only differing in intensity. Browns, russets, maroons, olives, citrons, and a host of others, were just anything he could guess at, and he never spoke of colours if he could avoid doing so.

Now this person was red-blind; that is to say, his retina, according to Young's theory of colour sensation, did not possess the nerve element which recognises or responds to the stimulus of the waves of light of the greatest wave length, and which produce the sensation of red. Hence red in its purest and most intense form disappeared from his chromatic scale, and in its lighter shades appeared grey, while in its combination with other colours,—as, for instance, in purple, which is a mixture of red and blue or violet,—it was overwhelmed by the blue, which explains why to his eyes no change was wrought in the red cabbage infusion by the acids. In like manner, the retina is sometimes deficient in the nerve element which recognises the medium rays of light, and green-blindness is the consequence; while a similar fault with regard to the short rays results in violet-blindness. For differentiating these various kinds of colour-blindness, we employ purple, because it holds the unique position of appearing of a different colour to

each kind. It is blue to the red-blind, because the red cannot be detected in its composition; it is red to the violet-blind, because the violet or blue cannot be detected in it; and grey (theoretically white) to the green-blind, because it is composed of his two (instead of our three) fundamental colours. The confusion of red and green by some colour-blind persons is explained on the Young theory by supposing that the nerve fibres of the retina devoted to the recognition of the red and of the green colours overlap each other, and rays of light failing to excite one set,—say the red,—excite to a less extent the next set, or green ones.

It is in consequence of the disposition of colour-blind persons to see many colours as grey, or mere shades of light and darkness, that art affords openings for the occupation of such persons. The engraver and other artists in black-and-white, engaged in reproducing coloured pictures, experience considerable difficulty in estimating the "shade value" of many colours which does not occur to the colour-blind. The following statement, also taken from Professor Wilson's list of cases, of the experience of a colour-blind engraver, will serve to illustrate this point, and perhaps, encourage others labouring under similar chromatic defects to turn them to good account. "Strange as it may appear, my defective vision is, to a certain extent, a useful and valuable quality. Thus: an engraver has two negative colours to deal with; that is, white and black. Now, when I look at a picture I see it only in white and black, or light and shade; and any want of harmony in the colouring of a picture is immediately made manifest by a corresponding discord in the arrangement of its light and shade, or, as artists term it, 'the effect.' I find at times many of my brother engravers in doubt how to translate certain colours of pictures, which to me are matters of certainty and ease. . . . The appreciation of the various shades of colour, or the weight of colour, as I may term it, is exceedingly nice and critical with me."

It is a singular fact, not without interest to persons engaged in arts and manufactures, that the decided forms of colour-blindness are much more common among men than women (in the proportion of ten to one), and that it is more common among the uneducated than the educated classes. At public schools and universities it exists to the extent of 2·5 per cent. while among the criminal classes it reaches the high rate of 11 per cent. This evidence points to a close connexion between colour-blindness and colour-ignorance, and shows the great necessity there is for the systematic teaching of colours in schools. To the majority of persons the very alphabet of colour is unknown; and even among artists, old and exploded theories of chromatics are obstinately retained in spite of the advances which the science has made in recent years.

## THE MONUMENTS OF ATHENS.*

HANDBOOKS dealing with the topography and monuments of ancient Athens have of late become plentiful. German readers are now in possession of Baedeker's excellent guide, and for English readers there is Mr. Murray's new handbook. The little work before us has a somewhat different claim on our attention. It is, so far as we know, the first attempt by a Greek to make the antiquities of his own country intelligible to his own countrymen. With this laudable end in view, M. Kastromenos tells us in his preface, he has "ventured to collect his feeble studies into the present treatise." If the studies have been feeble, we must own that the treatise has the merit of consistency; we regret this the more because the book is dedicated to the author's sister, Mdme. Schliemann, a lady whose just fame deserved a worthier tribute. "She it was," says M. Kastromenos, "who first took me by the hand and breathed into me a passionate love for the splendid monuments of antiquity, changing thus my original devotion to the Hermes of gain into a worship of the Hermes of learning." If the studies of M. Kastromenos correspond to his treatise, and both are "feeble," we must further allow to the translator a third correspondence. We remember Miss Agnes Smith as the author of a pleasant book of travels in Greece. When an adventurous lady tells us brightly the story of her tour through the difficult Peloponnese, we readily pardon a good deal of blundering over the names of gods and heroes, but when the same lady proceeds to translate an archæological book, and to give us renderings (very free "renderings") of inscriptions, we are bound to ask for a little care in spelling and translation. The book will, no doubt, be in considerable demand among non-classically educated travellers, both American and English, and though we can scarcely share the high hopes of the translator, that the intelligent seeing of the monuments will inspire these tourists "with a sense of the worth of humanity, and therefore the worth of their own individual life" (is this last needed?), yet they will find their archæological studies less irksome if they avail themselves of some such handbook as M. Kastromenos has prepared for them. Only, in the name of archæology, we implore Miss Smith to get her second edition revised by some scholar not wholly guiltless of elementary accidence. Was it wise without note or comment to translate *Ακαμαντὶς παίδων ἐνίκα*,—"the boys of Acamantis were victorious?" (p. 67). The monument of Lysicrates, from which the inscription is taken, gives rise to a good deal of unfortunate writing. It went by the name, as every one knows, of the Lantern of Demosthenes. No one who has seen the monument will wonder much at it being called a lantern, or get much help if he needs it from a sentence like this:—"It nevertheless appears that the name arose from the whole outer shape of the monument, which, in conjunction with the tradition about Diogenes, *was compared to the lantern and referred to the philosopher*" (p. 65).* A little further on we meet with the following rather hazy piece of information:—"The reward of victory in the Dionysiac festival at Athens was called a tripod. It was of bronze, and was termed choragic." At a certain festival we learn the spectators wore "what were termed *ἐρηβικοὶ πέτασσοι*, or broad-brimmed sun-hats"; a schoolboy who construed in this fashion would be promptly asked, which was "broad-brimmed" and which was "sun-hats," and would become manifestly uncomfortable. Even archæologists have their luck, but we are tempted to incredulity when we read,—"The forms of which we have spoken [*i.e.*, pulpitum, dromos, &c.] were distinctly shown when the theatre *was uncovered* in 1862 by the architect Shack, *with the help of a bronze coin*, on which the Dionysiac theatre was engraved." Is this a survival of the use of the divining-rod? Our suspicions are confirmed by many instances of very naïve logic, *e.g.*, "We have, therefore, no excuse for calling the monument the Arch of Hadrian, *inasmuch as the said name means something quite different.*" This arch of Hadrian has a chapter to itself; albeit, we are told "it is of no great interest, though it is not wanting in value nor in grace of execution or style." Fearing, we suppose, the charge of pedantry, Miss Smith docks Herodes Atticus of a syllable, and renders two respectable elegiacs thus (p. 49):—

> "Herod Atticus, of Marathon, had all that is here:
> He lies in this grave, and his name we revere."

Of him, among other things, we learn that he completed the Panathenaic Stadium, "giving it greater magnificence with Pentelic marble." Perhaps the mention of "Herod Atticus" engenders the Biblical phraseology, for we are told of the "sanctuary" of the Eumenides. "The Turks called this place *Karasom*, which, *being interpreted*, means "black water." Miss Smith has the sanction of the Health Exhibition when she writes "Hygeia" (p. 8); but it might be well to remember that, though the form occurs, it is confined to late authors and inscriptions.

There is really, we hope, nothing psychical or astral or otherwise ghostly about the Parthenon, but why are we assured that "it was built on the ruins and foundations of a more ancient temple, which may still be plainly seen, because the later one was 3 in. or 4 in. larger, *by a visible addition*" (p. 10)? We are sorry to hear that probably in the very earliest years of Christianity the masterpieces of classical art "quite lost their glitter"; but, after all, nothing is certain in this world, when "*the fact* of the temple having been built between B.C. 406 and B.C. 393 *is only a supposition* arising from a passage in Xenophon." The arrangement of the Erechtheion has always been considered somewhat problematic; perhaps the following sentence will throw some light on it. "We are unable to say anything either about the doorway or about the eastern wall, but we observe that at the antæ of the long walls on the northern and southern sides there exist, towards the interior, smaller pilasters opposite to them, and that this looks like the beginning of a wall which, nevertheless, probably never existed. *Yet there are railings.*"

As the translation of this book "has had the benefit of the author's supervision," we would gladly shift as much as may be of the blame on to the broader shoulders. The modern Greek language is, indeed, the outcome of centuries of degradation, and is little fitted to be the vehicle of exact ratiocination, or, indeed, precise statement of fact. But, if the book is to be of use,—which, if it were thoroughly rewritten, it might be,—to English readers, it must not do utter despite to the language into which it is translated.

* "The Monuments of Athens: an Historical and Archæological Description." By Panagiotes E. Kastromenos, translated from the Greek by Agnes Smith. London: Edward Stanford.

* The italics are throughout our own.

## NOTES ON WORKMEN'S HOUSES.

IN one of the latest of those most excellent volumes which have been the outcome of the last American census, is an article on the factory question by Col. Carroll Wright, the able chief of the Massachusetts Bureau of Industrial Statistics. It is replete with comparative information as to the position of the factory classes, not only in the United States, but in other countries as well, and some interesting information is given, the results of inquiries made by him on the Continent, as to the cost and style of artisans' dwellings, particularly in Belgium, Germany, and France. Taking these countries in the order named, we find that at Verviers, which is a busy clothing town, the workmen earn from 2s. 6d. to 3s. 3d. a day and the women 1s. 6d. to 2s. 6d., and they can rent four rooms and a small garden for 12*l.* per annum; two rooms on the second floor for 7s. 3d. per month, or two on the third floor for 3s. 8d. per month. The tenements are small, though comfortable, and, as a rule, the cottages are much better than the flats, which prevail to a considerable extent. Many of the houses, with four rooms, cellars, and scullery, let for 12s. per month. They have separate hall-ways and are generally well finished.

At Essen, in Prussia, the seat of Herr Krupp's gigantic steel and cannon-making works, a foreman gun-maker earns 9*l.* per month, and pays just that sum per annum for his house, which includes four rooms, a drying-place on the roof, a cellar, and a garden. An ordinary workman, earning 3s. a day, pays about 7 guineas a year for three large rooms, drying-place, cellar, and garden. For 20*l.* per annum an excellent tenement can be had, consisting of seven large rooms and the usual appurtenances. Every workman belonging to the place is housed in dwellings belonging to Herr Krupp, so that he can control all the sanitary arrangements and see that everything is done properly. There are three colonies of residents, each with its special name and laid out with parks, schools, churches, chapels, and stores. The housing of the single men at Essen is on the barrack principle. At Chemnitz, in Saxony, where men earn in the factories from 10s. to 20s. per week, working twelve hours a day, very good flats of three rooms can be got on second and third floors for 7*l.* per annum.

At Noisiel, in France, the seat of the Menier Chocolate Works, in the department of Seine et Marne, the selling price of an artisan's

dwelling is about 149*l.*, payable part down and the remainder by annual instalments. They are excellent houses,—the roof covered with Holland tiles, the gutters of zinc, and the window-sills and staircases of stone. The heating is carried out by stoves, the chimney-pipes being taken up the walls in a hollowed groove. The floors of the upper stories are of pine, and the interior staircases of beech, the ceiling above the cellar being plastered, and the kitchen paved with tile or brick. The price of these Noisiel houses has recently been raised, for the purpose of preventing speculators from buying them in the name of working men, and also to prevent sub-letting.

The factory town of Mulhouse, in Alsace-Lorraine, offers great advantages in the direction of housing the working classes, partly on account of the well-known care devoted to the subject by the employers, and partly from the number of industrial societies. The usual plan here is to build four separate houses under one roof in a square, each fourth part constituting a dwelling. The average cost of a house here is 86*l.*, plus the price of 192 square yards, which is nearly 6*l.* The yearly rent is 7*l.*, the tenant becoming owner at the end of fifteen years by paying in addition 4s. 6d. per month. The houses are coated with mortar made of hydraulic stone and river sand, coloured white, yellow, or gray. The sills of the windows and the threshold of the floors are of stone, the lintel bars of round iron, and the houses are separated by lattices made of oak laths. The area covered by the house is 38 square yards. The framing of the windows is of stone without projections; the chimney-shaft is of brick, and the roof is covered with tiles. The privies are always placed in the garden, and the inside of the drains is covered with cement, the bottom being of concrete. The refuse water of the household runs into the main sewer, and the water supply is from pumps set over well-holes 20 ft. deep. The smoke-pipe is of sheet iron, and after it leaves the stove in the dining-room it connects with a pipe of double-burnt earthenware, so as to avoid condensation in going through the kitchen.

In the United States considerable attention is now being paid by employers to the subject of workmen's dwellings, and particularly in New England, where the bulk of the factory labour is congregated. Foremost in this direction is the Willimantic Linen Company in Connecticut State, which has recently built some really charming sets of cottages with large gardens, ranging from 12*l.* to 25*l.* per annum rental. As no two are alike, they offer real facilities for inculcating amongst the inhabitants a taste for art decoration.

## NOTES.

IN the *Times* of Tuesday last the Dean of Peterborough enters into a pretty long defence of his position in regard to the restoration, a defence which appears very rational and complete. The Dean can write common sense on the matter without vilifying other people, and is in a much better position as his own advocate than when allowing Sir E. Beckett's amenities to interpret for him. From this letter it appears that the present position is, that the Chapter have agreed to allow raising the tower, on condition of having the pointed arches rebuilt. This is, as we have already said, an illogical and half-and-half measure, which is good neither architecturally nor archæologically. The Dean says very pertinently that he has had several offers of additional funds on condition the Norman arches are restored, "but who will contribute towards a patchwork of this kind?" If this be done, a foolish and irrational thing will be done, which future generations will vainly regret. Mr. Freeman endeavours to draw a distinction between Chichester and Peterborough, because in the former case the tower fell, in the latter it has been taken down to prevent it falling. This is rather too fine-drawn a distinction for most of us to see. Mr. T. G. Jackson, who reiterates his conservative protest, justly complains of Sir E. Beckett referring to him as an "amateur" (which may have been either ignorance or impertinence),* but when he persists that to build up the old tower, stone for stone, is "the best we can now do," though we admire his modesty, surely we may ask him to be content with speaking for himself.

THE conference presided over by Lord Henniker on the 14th inst. proved most unmistakably that the proposed new railway Bills will be very strongly opposed in Parliament. Five M.P.'s, representing various trading interests, were present, the resolution pledging the meeting to oppose the measures being moved by Mr. Barclay, M.P. The closer the schemes of the companies are examined the more reason there seems for regret that they are so overreaching as to provoke such hostility. There is evidence of an immense amount of trouble and care having been expended in their production, and that every point has been exhaustively considered. It is quite time, too, that the Railway Clearing-House Classification (which we referred to last week as having never been legalised) should receive Parliamentary revision and sanction. This is continually fluctuating, and the trader is never secure from having his particular manufactures suddenly moved up a class. The radical changes recently made in the "smalls" and "owners' risk" systems were so damaging to the traders that they would, doubtless, be much relieved to find the classification more of a fixture. There is much that is useful in the measures, but the powers sought for would bring the companies' maximum rates up so high that they will hardly be allowed to pass a second reading. The resolution passed by the meeting was forwarded to the President of the Board of Trade, with a request that the views of the Government should be stated at the earliest opportunity, and it will be interesting to know how Mr. Chamberlain and his colleagues regard the state of affairs.

ONE item in the news contained in the *Archäologische Zeitung*, the publication issued yearly by the Archæological Institute of the German Empire, is a full and precise account of the acquisitions of the British Museum during the past year. The account is extracted from Mr. Newton's annual report to Parliament, and records not only newly-acquired statues, but gems, terracottas, vases and all miscellaneous antiquities. Would not the *Journal* of the Hellenic Society be doing good service if, in one of its two annual issues, it published a similar report? And could it not place itself in connexion with all Continental museums under state control and publish yearly, at least, an abstract of their official report? One of the great difficulties in archæological research is the getting together of the necessary material, and, indeed, often the uncertainty as to where that material exists. With respect to private and small municipal collections, we fear that difficulty must long exist, but with State collections the information is to be had, and only needs to be made accessible. If we may be pardoned a second suggestion, we believe that the Hellenic Society's *Journal* would do good service if it further devoted a couple of pages yearly to the enumeration of the contents of the various German, French, Russian, and modern Greek archæological periodicals, and to the citation of all important monographs, such as are not always accessible even in University libraries.

IN reference to the subject of building leases, it may be observed that these are almost unknown in Scotland, and the consequence is that the general run of buildings erected there are of a substantial and permanent nature. The practice is to build upon a feu contract, under which the feudal superior, the owner of the land, grants to the feuar a permanent right to the holding upon payment of a fixed annual feu-duty. A plan of the ground to be feued is prepared by the architect of the superior, and if streets are to be erected thereon he generally also prepares the elevations, a copy of which he is bound to give to those who take a portion of the ground upon payment of a stipulated fee. When the ground is laid out for villas, each villa must cost not less than a certain minimum, and the plan be approved of by the ground architect. In the southern district of Edinburgh the annual feu-duty asked is now double the amount given about twenty years ago. It was then at about the rate of 20*l.* per acre, and is now about 40*l.* This of course enhances the value of the older feus to the holders, as the superior cannot demand more than the sum stipulated in the contract. The feus for streets are based upon the frontage generally from 1*l.* per foot and upwards. Feu duties are considered most eligible investments, many of them being purchased by insurance companies, and for endowed institutions they form a first claim upon the property, and are easily collected. In some instances a "duplicand," or twice the annual value, is exacted every twenty years, but this practice is now, we believe, falling into desuetude. There is generally a clause in the feu contract under which the feuar can redeem the annual duty upon payment of a certain number of years' purchase-money. The system is found to work easily, and does not lead to the evils which supervene upon terminating building leases.

ON Wednesday morning, the 7th inst., a large crowd of unemployed working-men, estimated at between 200 and 300, many of whom belong to the building trade, assembled in front of the Council-house, Birmingham, for the purpose of seeking an interview with the Mayor, with a view to getting employment by which they and their families might continue to live. The Mayor (Alderman Martineau, a nephew of the great authoress) declined to see them, and referred them to his secretary, who, after hearing the statements of a small deputation, told them that the Mayor had no power to give them employment, and referred them to the Public Works Committee as represented by the Borough Surveyor. This did not satisfy the men, and they then sought to see the Mayor at his private residence at Edgbaston, but there they were met by the police, who drove them away. These unfortunate ignoramuses in distress protested that they had supposed the functions of Mayor to be of a less ornamental character than it appeared. Since that time mass meetings of the unemployed have been held, at which from 4,000 to 5,000 men have attended, and processions through the town have taken place with the object of calling public attention to the prevailing distress, with the result that the Public Works Committee have hired the stone-yard attached to the Workhouse from the Guardians and set some score or two of men breaking stone for the roads, a very small result as yet, and one not likely to meet the necessities of the case, seeing that many of the distressed are jewellers and others whose work has been of a similar light nature, and whose hands and general physique are not suited to such employment. Meantime the distress is increasing. It is reported that the Messrs. Tangye (Limited) have discharged some hundreds of their workmen, and placed many others on short time, and many factories in the district have not half enough to do.

THE London, Tilbury, and Southend Railway Company obtained powers last session to acquire certain property at Whitechapel for the purpose of their undertaking, and this property, which included the German Reform Church on the east side of Hooper's-square, Leman-street, Whitechapel, and the Seventh-Day Baptist Chapel, Mill-yard, Leman-street, with the disused graveyard in the rear, was purchased by the Company. There appears to be some difficulty in dealing with the ground as building land, and a clause has been introduced into a Bill promoted by the Railway Company to exempt the portions of the

* From a subsequent letter, even more insolent than usual, it appears to have been ignorance. We should have supposed Mr. Jackson's name was pretty well known; but his reputation is in connexion with the artistic side of architecture, of which Sir E. Beckett knows nothing; and besides, Mr. Jackson does not write letters to the *Times* to advertise his own books and buildings, and his own greatness generally, as Sir E. Beckett is allowed to do.

premises referred to from the operation of the Disused Burial Grounds Act, 1884. This will be good news for the Society with the lengthy name of which Lord Brabazon is chairman, and it seems to show that the Act in question is not entirely inoperative. The disused burial-ground contains about a quarter of an acre, it is situated in a densely-populated neighbourhood, and would, no doubt, be an acquisition as an open space ; but it would be too much to expect the Railway Company to relinquish it, after having paid for it as building land, for the value which would be paid for it as ground which is not capable of being built over.

THE new volume of the Architectural Association Sketch Book contains a great deal of interesting matter, and is quite an important addition to an architect's library, whether only to turn over for pleasure, or to use for the higher and more rational end of "cribbing." There appears to be rather less of clean and highly-finished drawing than there used to be in some old numbers, but a great deal of admirable and sufficiently clean sketching. Opinions, as practically shown, differ about the relations of lines to actual facts. One draughtsman conceiteth himself that he shall show the inner angle where a wall meets, a buttress, for instance, by a thick dark line ; yet there is no line at such a place in the building itself, saving that formed by the difference of the incidence of light on two different planes of wall. Another will be for leaving out all lines except the joints of the masonry, and showing those as thick as ropes, so that the drawing is all joints and no angles. This is called "force." There are many drawings that keep a sensible medium, and represent accurately and with balance what line, without shading, can represent. There are some brush drawings reproduced by Sprague's process, among which certain by Mr. Lethaby are pre-eminent in artistic feeling. We do not think the border of the title-page very happy ; the straight zigzagged main lines of the floral design are too stiff, and, moreover, they look rather as if they were pulled over the circular medallions as over pulleys. Some of the buildings sketched remind us how deficient is our modern architecture, most of it, in simplicity and breadth of style : the Holstein Tower, Lubeck, for instance, with its great unbroken round towers, and the arcaded work between them.

DR. WALDSTEIN, the curator of the Fitzwilliam Museum, commenced, on Saturday last, a course of three afternoon lectures at the Royal Institution, on Greek Sculpture from Pheidias to the Roman era. His view of the subject turned more especially on the relation between the sculptor's aim and the sculptor's material ; the archaic age showing a want of harmony in one direction, the imperfect rendering of natural facts, which obtruded on us the idea of stone or bronze, of rigid material rather than of life ; and the sculpture of the decadence showing a want of harmony in the opposite direction, in a too great realism, and in the representation of momentary and complicated action which was unsuited to the condition of sculpturesque material. The canon or type of human sculpturesque form, as evolved by Polykleitos, was illustrated by casts of the existing copies of his "Doryphoros" and "Diadumenos" (spear-bearer and diadem-wearer), and the lecture concluded by a reference to the statue ascribed to Kephisodotos the elder, and formerly called "Leucothea" (a female with a child in her arms), and its recent identification by Dr. Brunn with the subject of "Eirene and the infant Plutos." The next lecture, to-day (Saturday), goes into comparison between the age of Pheidias and that of Skopas and Praxiteles, and the special qualities of the latter; and the third lecture, on the following Saturday, will be devoted to the age of Individualism, and to Græco-Roman art.

IN a letter to the *Athenæum* of last week Mr. Albert Hartshorne draws attention to the announcement that subscriptions have been started for the restoration of the Eleanor Cross at Northampton, which was restored, in a very conservative manner, only forty years ago by Blore. That it should now need restoration or repair again is attributed by Mr. Hartshorne to the manner in which it has been maltreated by missiles thrown at the figures in the ingenious sports of the youthful inhabitants. He expresses a hope, which we share, that the old figures, though dilapidated, may not be removed with the view of setting up restored imitations. Such a proceeding would be simple Vandalism. Purely architectural detail which has been damaged, and of which some portions remain as models, may be restored in a sense ; but the work of the sculptor stands in quite a different category. No one can restore that.

WE learn with much pleasure that Miss J. E. Harrison, whose critique on the Pergamene altar we published last week, has "received a call" from the managers of the Museum at Leicester to deliver a course of lectures on "Greek Art." For some time past Miss Harrison has been attracting ever-increasing classes to her lectures at the British Museum, and the success she has met with there bears witness not less to the interest of her subjects than to her powers as a lecturer. When Miss Harrison some three or four years ago, under the strong insistence of Mr. Newton, C.B., and other competent judges, made her first attempt to raise the interest of ladies in the treasures of Greek art in the British Museum, some ten or twelve "amateurs" were with difficulty got together. In her course brought to a conclusion at Christmas more than eighty "students" were regular in their attendance, and there is every reason to suppose that both the elementary and advanced classes which will meet in the Archaic Room of the British Museum during the next six weeks will not be less fully attended.

THE "Society of Painter-Etchers" announce their Exhibition for this year to take place at the Dudley Gallery, opening May 25th. All forms of engraving on metal, whether by the burin, the etching-needle, by mezzotint or aquatint, or by whatever other process the artist may choose as a means of original expression, are understood to be included in the term "painter-etching," and are eligible for exhibition, provided that they are *bonâ-fide* original works, not reproductions.

A COURSE of fifteen lectures on Practical Surveying, with special reference to the forthcoming examination at the Surveyors' Institution, will be commenced by Mr. G. W. Usill on February 2nd. Seven will be on office work, and eight in the field on Saturday afternoons.

FROM a correspondence in the *Dundee Advertiser*, which has been forwarded to us, it appears that at a meeting in connexion with the Dundee Institute of Architecture, Science, and Art, the other day, the Rev. G. Mure Smith gave a lecture on bells and bell-music, especially dwelling on the beauty of old tunes chimed upon bells, carillon-fashion. Whereupon Mr. G. S. Aitken, architect, writes to the *Advertiser* (which gave a good report of the lecture) to the effect that bells were not meant for playing tunes upon, but rather for a "mosaic of sound," and that change-ringing was a far more suitable way of using bells than chiming. We are with Mr. Aitken entirely. Bells are not really musical instruments ; they are too uncertain both in time and tone, and destitute of expression; they are an "effect," that is all. Moreover, we never heard a carillon tune that was properly IN tune ; and people in this country do not seem to know, or to mind, whether they are or not. Indeed, at one church in the vicinity of Aldgate there is a tune-playing carillon which plays more than one well-known hymn-tune with absolutely wrong notes in certain places, in order to escape the expense of another bell to give the note wanted. It is difficult to know in this case whether the people who made the peal, or those who accepted it in this form, were the greater idiots. But at the best, carillon-playing is only trying to make bells do what they are not fitted for.

UNDER the title of "Salon Parisien," a collection of paintings, of which the bulk are by M. Jan Van Beers, has been opened at 160, New Bond-street. There is no work there equal to his "Soir d'Été," which we specially noticed in last year's Royal Academy ; but there is a great deal of exceedingly clever painting of figures and costumes, the most marked characteristic of the exhibition being a number of studies of exceedingly over-dressed young women of a very *demi-monde* type (in some cases we might say not even "*demi*"), varied by some which are the reverse of over-dressed, sprawling on sofas and chairs in such attitudes as may best exhibit the artist's powers of drawing and foreshortening. Some of these, as "Mélancolie" (4), and "Fatigue" (14), are as clever in execution as anything in realistic art that is to be seen at present. Occasionally there is a higher note struck, and some of the larger quarter-length paintings, such as "Stella" and "Irma" (24, 26), are very sweet in expression as well as beautifully finished in execution. The "Portrait of Peter Benoit" (28) is admirable as a realistic portrait, and one or two works seem to indicate that M. Van Beers could paint a lady if he chose. As it is, the collection stands as one of the cleverest and one of the most intensely vulgar picture exhibitions which have been seen in London. The very title-page of the catalogue (drawn by the artist), across which prances a *danseuse* of the lowest type, is enough to frighten away respectable people, and suggests the idea of its being a "music-hall" programme rather than the catalogue of a picture exhibition. We will not insult our neighbours by accepting this exhibition as representing *l'Art Parisien*, but it represents a certain type of French art of which there has been a great deal too much of late years.

## RECENT DISCOVERIES BY THE AUSTRIANS IN LYCIA.

THE book that lies before us,* the official account and publication of discoveries made during the two recent expeditions made by the Austrians to Lycia and Caria, has long been eagerly looked for,—nowhere, perhaps, with such eagerness as in England. Englishmen were the first to penetrate the mountain fastnesses of Southern Asia Minor. We have had first Fellows, then Spratt, Forbes, and Daniell, later Waddington and Falkener. The British Museum is rich beyond any other collection in Lycian marbles. We have the matchless Harpy tomb, the most wonderful and beautiful monument that archaic art has left us; we have the Nereid Monument of Xanthos from Caria ; thanks to the skill and energy of their present guardian, we have the Mausoleum marbles now worthily housed in their new and splendid hall. To the long series from Lycia, some of us feel, very bitterly, that England might have added the two great friezes from the Heroon at Djölbaschi, friezes which are now the chief treasure of the Museum of Antiquities at Vienna. It would have been for the advantage of all archæological Europe could these sculptures have been seen side by side with our already exciting Lycian collection. But England was too poor or too niggardly or too ignorant,—which was it ?

The time is gone by for lamentations. It remains for us now to learn from the publications of the Austrian Government what was the treasure which might have been ours, and to console ourselves, as best we may, by the cheering fact that our nation possesses a *cast* of part of these Lycian marbles, set up in the Kensington Museum.

We may as well say at once that this Djölbaschi Heroon, which has brought such honour and glory to the Austrian nation, and which weighs so heavily on some British consciences, is not the subject of the present volume. The Heroon and the sculptures that adorned it are to have a separate book to themselves. The re-discovery and removal of these sculptures was, indeed, the object of a separate and special expedition, which started in 1882, the

* Reisen in Lykien und Karien, ausgeführt im Auftrage, des K. K. Ministeriums für Cultus und Unterricht unter dienstlicher Förderung durch Seiner Majestät Raddampfer "Taurus," Commandant Fürst Wrede beschrieben von Otto Benndorf und George Niemann, mit einer Karte von Heinrich Kiepert, 49 Tafeln, Zahlreichen Illustrationen im Text. Wien, Carl Gerold. 1884.

funds for which were supplied, as is well known, by private subscriptions among a few Viennese nobles and gentlemen. All the at present accessible information about this Heroon has already been made known in the *Builder* in the reports of Professor Newton's lecture on Djölbaschi, at University College; for the rest, we have to wait the appearance of the promised book. The volume we have at present in hand is the first of two. In these two (the second of which is to be edited by Drs. Petersen and Felix von Luschau) are to be contained the whole account of the discoveries of the two expeditions in 1881 and 1882 respectively, *excepting the Djölbaschi Heroon*. The present volume takes the expedition of 1881, but its statements are corrected when necessary by the experience of 1882.

To Dr. Benndorf, in the main, is due the first inspiration. The Lycian Apollo had long haunted him with prophetic signs and omens. At last, when the Austrian excavations at Samothrace were closed, the suggestion often made to the Government by Dr. Benndorf took shape and became active. In the spring of 1881 Dr. Benndorf, with, as his colleagues, Professor Niemann for architecture, Dr. Felix von Luschau for natural history, and last, but not least, the Court photographer, Wilhelm Burger, set out for Constantinople. We may well give honourable mention to Wilhelm Burger, for to his skill are due the forty-nine exquisite photographs heliographed for the book. In a country like Lycia, where topography and architecture and sculpture are so *implicated*, these beautiful illustrations are of the first importance. We may say, before turning to the substance of the book, that it is printed in luxurious folio; that, besides the heliographs, there are eighty-nine woodcuts and 132 facsimiles of inscriptions, all published for the first time. To these we must add a beautiful map embodying the latest corrections and additions to the map of Spratt.

The man-of-war *Taurus*, in which the expedition started, was not destined to go straight to the land of the Chimæra. Putting in at Smyrna on the 4th April, the explorers were met by the terrible news of the great earthquake at Chios, and they charitably turned aside to carry help to the sufferers. Dr. Benndorf devotes a whole chapter to this Chios earthquake. We may as well say once for all that the reader who expects to find in this book a purely archæological treatise will be, according to his individual taste, agreeably or disagreeably disappointed. Drs. Benndorf and Niemann write advisedly in a somewhat popular style, more after the fashion of the bygone *dilettante* traveller than the modern archæologist. Their book is pleasant reading to the amateur, for the many inscriptions and architectural measurements are plentifully besprinkled with details of Lycian modern life and customs, but particulars about the number of mules, the weather, and the roads are to the specialist somewhat irritating.

These we omit. After four days' delay at Chios, the voyage was continued; the explorers availed themselves of facilities for landing on the way to Lycia, and stopped for a short time at Halicarnassus, Cos, and Cnidos, Loryma, and Rhodes. At Halicarnassos, Dr. Benndorf copied three inscriptions, and was so fortunate as to buy a sculptured bas-relief of white marble, which now, with all the other results of the expedition, is to be seen at Vienna. The slab is no great size, but from its style, and from iron clamps still remaining on it, it must have formed part of a frieze. It represents two youths on horseback; they wear short chitons girded, and from the symmetrical way in which they sit, they seem to be engaged in some formal race or competition. The relief is in bad preservation, the heads of both riders almost effaced. It was found in a courtyard of the Greek quarter of Halicarnassos, and Dr. Benndorf conjectures that it may once have belonged to the palace of Mausolos, the site of which, according to Mr. Newton, is to be sought for close to the present Greek quarter.

The 10th of April found the explorers at Cos. The modern wonder of the town of Cos is its huge plane-tree (beautifully reproduced in phototpye I.). It stands in the place of Hippocrates, with its huge ancient branches supported by wooden stays and stone pillars. Two Turkish *cafés*, the resort of all the town, find shade and shelter beneath it.

Leaving the town proper, the explorers passed to the castle by the sea. At the entrance, over the first door, Dr. Niemann noted and sketched some slabs of marble, sculptured with masks and festoons of very late Greek style, and built into the rough stone wall. The masks are Satyr types not unlike those on the round Dionysos altar at Athens. Inside the castle (entrance to which was only obtained with difficulty) Dr. Niemann found three interesting slabs with figures sculptured in high relief. The slabs lead into two walls standing at right angles to each other in a garden within the castle walls. These slabs had been seen by Mr. Newton in his researches at Cos, and he conjectures that they may have been taken away from a temple at Cnidos by the Knights of St. John and built into the wall of this fortress of Theus at Cos. The slabs had, since Mr. Newton's visit, been heard of, but not seen, by Ludwig Ross, who failed to obtain access to the castle, and they were somehow passed over unnoted by M. Oliver Rayet, though he noticed some similar slabs outside the castle wall. Dr. Benndorf now publishes the slabs in full. The sculptures represent three figures in excited motion between an altar and a cista. Near the cista is a large snake rearing upwards in many coils. The figure nearest the left is advancing to the cista and extends her right hand to the snake; in her left she holds something, which is probably a thyrsos: she is dressed in a long sleeveless chiton and a *himation*, which forms an arch behind her head. To the right, at the opposite end to the cista is an altar, near which a male figure takes refuge, leaning on the altar with his left hand. He raises his right as if in fear or astonishment. The lower part of his body is draped by a *himation*, which, as in the case of the woman, forms an arch behind his head. Between the man and woman stands a female figure, with both arms outstretched as if in interposition. It seems probable that we have here a scene from the life of the semi-Hellenic semi-Oriental god whose worship was so popular in Phrygia, Dionysos Sabazios. His worship was closely connected with that of Rhea and with the Orphic mysteries. Apollodoros (III. 5, 1) tells us Hera,—who never seems to have been happy unless she was persecuting some one else,—drove Dionysos mad, and made him wander from place to place, till at last he came to the goddess Rhea. She purified him from his guilt, and taught him the mysteries. It may be that here we have the scene of reconciliation and purification. The snake was specially sacred to this Dionysos Sabazios; a golden snake was given to the initiated in his mysteries ("Aureus coluber in sinum dimittitur consecratis et eximitur rursus ab inferioribus partibus atque imis."—Arnob. 5, 21). The two other slabs seem to form one composition. On the one slab, to the right, are three figures dancing, two of which at least seem to be Satyrs; on the second slab, to the left of the Satyrs, a tree, and near it a male and female figure, both standing; the woman seems to have her arm about the neck of the man. The group probably represents Dionysos and Ariadne; to the left two figures, probably dancing Satyrs. The whole relief is much effaced.

So much for the sculptured remains inside the castle. On the outside built into the wall of a bastion near the sea are further analogous fragments reproduced in Plate IV. exactly as they now stand in the bastion. The topmost piece of frieze was built in concrete of two slabs, in each of which are four figures. On the left-hand slab is a group of two seated figures; a bearded god, with a *himation* across his knee, sits leaning on his left elbow, and holds in his right hand something which may be a sceptre or more likely a thyrsos; a goddess, richly draped, sits by his side, holding in her left hand some attribute too much mutilated to be made out. To the group there advances from the right a woman figure, and offers to them some large object she holds in her hand. To the right of this figure, and on the second slab, a Satyr is dancing with three Maenads. One of the Maenads plays the cithara, the Satyr plays the flute, a second Maenad the tambourine, while the third swings the thyrsos. Lower down on the bastion is a second bit of frieze, the subject of which is barely recognisable; a Satyr may be made out with a panther skin waving behind him; he seems to be holding a shallow cup in front of some wild beast to tempt him on. Two other Satyrs are busy about a preparation for a drinking bout, one is emptying a wine-skin which he carries on his shoulder into a krater held by the other Satyrs by the rim. It is interesting to compare these frieze fragments, now that we have authentic photographs of them before us, with the similar fragments that Mr. Newton describes as seen at Cnidos ("History of Discoveries," p. 449). Dr. Benndorf cites as follows: "A seated female figure, her lower limbs enveloped in a peplos. She looks towards a Satyr, who stands before her brandishing in his right hand what appears to be a thyrsos; his left is extended towards the female figure, and has probably been enveloped in a mantle. On the left of this group is another Satyr moving away from the scene, but looking back. In the other relief a female figure is seated on rocks before an altar. The lower half of her body is clad in a peplos; in her left hand she holds some uncertain object. She is looking back. Behind her stands a female figure, having a peplos wound round the lower half of her body. The seated figure in this group may, perhaps, represent Ariadne." Mr. Newton adds that the execution of the work is poor, and dates it as late Roman. A comparison of the now published figures at Cos, with this description of the fragments of Cnidos, leads almost inevitably to the conclusion that Mr. Newton's conjecture was correct, that all the fragments of the frieze came originally from Cnidos, and that some portions were carried as building material to Cos, by the Knights of St. John; further, that as the subjects are so manifestly Dionysiac, the original source of the frieze must have been the temple at Cnidos, which stood close to the theatre, and was, therefore, in all likelihood, sacred to Dionysos. The male and female figure twice found in conjunction would then of course be Dionysos and Ariadne, not, as has been suggested,—in consequence of the snake,—Asklepios and Hygieia.

The explorers spent the remainder of their time at Cos in investigating the plain west of the town where M. Rayet ("Milet et le Golfe Latmique") believed he had detected the remains of an ancient Asklepeion. Their efforts were in vain, but in their wanderings they came across inscriptions and countless architectural remains, notably a number of funeral monuments in the form of cylindrical altars surrounded by sculptured wreaths in Hellenistic and Roman fashion. Some of these were well preserved, others completely in fragments, and these fragments built into modern walls. Of one curious marble slab Dr. Niemann took a sketch. The slab is finely worked, and has on the upper part a round shield in relief; it probably formed the side-wall of an ædicula. Coming back to the town they came across the remains of a Roman aqueduct, also the foundations of a theatre a considerable size. Near the theatre they found a fragment of a colossal female head; probably, from the treatment of the hand, the portrait of a Roman empress. In the town itself they bought two pieces of sculpture in marble, now in Vienna. A seated figure in a sort of archway in relief, no doubt representing Cybele. The goddess has her feet on a footstool, and is dressed in a gilded chiton and a *himation* thrown over the knees and the left shoulder. Under the left arm she holds a tympanon; her right, much mutilated no doubt, held a cup. On her knee reposes a lion. This relief is interesting because its restoration is certain; because, as the marble of which it is made closely resembles the Pentelic marble. The type of the goddess mother, seated in a little shrine with a lion on her knee, a cup in her left hand, and a tympanon supported upright on her right, and leaning against the right arm, occurs with extraordinary frequency in Attica, and in isolated instances outside Attica, where, as a rule, exportation can be manifestly proved. It was a common custom among the ancients in any place where a special cult prevailed for little copies of the shrine of the god or goddess, containing the sacred image, to be cheaply multiplied. For example, in Sicily, countless little terra-cotta figures are to be found in every collection, public or private, representing a goddess of somewhat archaic type, sometimes seated, sometimes standing, a modius on her head, and in her arms either a dove or a pig; in the one case she represents Aphrodite, in the other Demeter. Such images were probably not for temple service,—they never bear inscriptions,—but for daily household reverence. We have only to recall the silver shrines made for Diana of the Ephesians, and, indeed, the modern trade in Madonnas. The cult of the goddess Cybele, mother

of the gods, was, we know, much reverenced at Athens. Pheidias, or his contemporary, Agoracritus, made a statue of the goddess for her temple at Metroon. In all probability it is a rough copy of this statue in the Metroon that we possess in the Cybele figured by Dr. Benndorf, and repeated in countless replicas, many of which may be seen in the public museums of Athens. About them all, rough though they are, there hangs something of the grand ideal manner. The cult of Cybele, like all other Oriental forms of worship, became, as is well known, very popular in the fourth and third centuries B.C. Probably it was during these Hellenistic days that the copies were made for private worship.

The second piece of sculpture obtained at Cos is less interesting in subject, but far better preserved. It is of coarse white marble, a figure of a woman, and reproduces the familiar motive popularised by Niobe's daughters,—a maiden bending forward as she moves awry, and lifting up her robe.

Leaving Cos the *Taurus* passed on to Cnidos. Little could be done there but to follow in the footsteps of Mr. Newton and to find that many sites and remains described by him had already disappeared. A few coins and fragments of terra cotta were collected, the best of which represents the youthful Heracles with bow and quiver, lion's skin, and club (an apparatus unusually complete, the bow and quiver belonging to his early, the lion's skin and club to his later, accoutrements). Dr. Benndorf found his chief interest at Cnidos in investigating modern life: he gives a very full and elaborate account of the weaving processes of the Carian peasantry, an account instructive, because of certain analogies between ancient and modern process. At Loryma Dr. Niemann made careful architectural investigations about the fortress on the Acropolis, which seems to have served in turn the purposes of Carian pirates and Rhodian conquerors. The remains of these successive systems of building are still recognisable. At Rhodes the explorers were received by the Italian Vice-Consul Bibotti, and obtained from his collection some valuable vases and terra cottas, chiefly archaic. An account of the whole collection is promised in a later publication. At Rhodes Dr. Benndorf parted from the civilised world; his discoveries in the wild highlands of Lycia we must postpone to another time.

## THE LATE MR. SAMUEL HUGGINS.

WE regret to have to record the death, at Chester, on the 10th inst., of Mr. Samuel Huggins, whose name will be known to many of our readers. Mr. Huggins was born at Deal in 1811, but spent most of his life in Liverpool. He was educated as an architect, and had a keen love of architecture as an art, and a great knowledge of its history, as well as a very clear-seeing critical intellect. He was, however, a sensitive and retiring man, and never seemed able, or even inclined, to try for success in the field of active professional work; but it is a mistake to suppose (as from some notices of him in local papers seems to have been supposed) that he was only a writer and a critic. He was, during a great period of his life, a frequent and diligent designer, but his designs were for his own pleasure and study merely,—at least, they mostly did not take practical form; but some of them would be very interesting to architects. Mr. Huggins was a devoted Classicist, but he did not consider that Classic architecture in the present day consisted in copying orders or Italian details; on the contrary, he was always urging the study of new combinations, and had portfolios full of small studies of his own, mostly shaded in Indian ink, of numerous "variations" on columnar architecture, in the form of designs for imaginary buildings and monuments. Our impression from recollection (it is many years since we had the pleasure of looking over them) is that many of these are worth publishing in some form. At one time, we remember, their author contemplated offering them to the Library of the Institute of Architects.

Mr. Huggins put together, in 1863, a chart of architectural history, showing the relation and progress of the leading styles in the form of a river; it was very well done, and in a way that made it a good memorandum also for dates of architectural epochs. It was accompanied by a small book entitled "The Course and Current of Architecture," giving a very well-written critical review of the leading styles.

Mr. Huggins took a very active part in the protest against restoration which commenced a few years ago, and was, like some other "protestants," rather one-sided in his views on the matter. He has also the distinction of having made one of the very best-arranged catalogues of a library, that of the Liverpool Free Library, which could be met with: a kind of good work for which all students of books ought to hold a man's memory in good repute.

Mr. Huggins wrote a good deal in our columns at one time, mostly under his own signature, and he was a frequent and very excellent contributor to the Transactions of various learned or literary societies. Personally he was a man of very high and unselfish character; his own advantage, either in the form of money or reputation, seemed to be the last thing he ever thought of; he was of a very reverential turn of mind, though holding very "advanced" views both in religion and politics; and he had an ardent love of nature. He was a good and intellectual, though not a strong or a successful man. *Requiescat in pace.*

## THE VENTILATION OF PUBLIC BUILDINGS.*

THE subject of ventilation is usually looked upon as practical rather than artistic, in spite of the fact that the architectural journals now contain an advertisement of "Artistic Ventilation," but it is to the art-loving section of our body that I would particularly address myself rather than to the so-called "practical men." If we will only study the fundamental principles of these sanitary questions, we shall be able to combine the science which is demanded of us with the art that we love.

The subject divides naturally into two parts, the principles and the practice of ventilation.

The following appear to me to be the fundamental principles of all ventilation, and as they are seven in number, we may, if you please, call them the "seven lamps of ventilation."

1. Ventilation is the substitution of foul air by fresh air, and is only successfully effected when without draught.

2. Foul air is air vitiated to a certain definite extent.

3. Fresh air is air in a normal state of purity.

4. Draught is the unpleasant contact of moving air with the person.

5. Air is a fluid and a gas.

6. Heated air is lighter than cold air of equal purity.

7. Foul air is heavier than fresh air of equal temperature.

Before passing on to the practical application of these principles, we may profitably spend a little time in considering each of our "lamps."

We first said that "Ventilation is the substitution of foul air by fresh air, and is only successfully effected when without draught." Many, indeed the majority of the public, imagine that the object and aim of ventilation is solely to produce an agreeable temperature, and, if the room is too hot, they exclaim against the want of ventilation; if too cold, they find fault with the excess of ventilation; but we must remember that purity of the air it is that depends on ventilation, and that temperature is no criterion of the purity of the atmosphere. Note also that ventilation is the substitution and not the dilution of foul air by fresh air. When the air has become vitiated we must not simply dilute the air with fresh, but remove it altogether, and substitute fresh air in its place. Such is the ideal view of ventilation, but, owing to the natural laws of gaseous fluids, we shall find that an approximation only to this requirement is possible. It is, however, an end to be aimed at, even if we can only partly attain to the realisation.

The necessity for the fresh air is found in our dependence upon a pure atmosphere for our health and vigour. The inhabitants of close rooms, persons who breathe air which has already been breathed, are subject to diseases which may cause death, amongst which may be mentioned pulmonary consumption and certain classes of fevers. But whilst some persons may be killed outright by breathing air which has been polluted by the breath of other persons, the majority are subject to a low condition of health. The reason of this is partly because the oxygen of the air is necessary for keeping in activity the chemical processes upon which life depends, and that, in the act of breathing, the oxygen in the air is taken up by the lungs, and the expelled air is thus deprived of its oxygen; and partly because an individual in expelling the air from the lungs expels with the air carbonic acid gas as well as a large quantity of organic matter, *i.e.*, a portion of the body, which latter has a tendency to putrefy rapidly in stagnant air, and which may thus become a dangerous poison.

We said that ventilation "is only successfully effected when without draught," the reason of this provision is obvious: if draught is felt, the public at once prefer to have no ventilation at all than to have it with draught, for the evil effects of foul air are slow and insidious, the effects of draught are palpable and immediate.

Our second definition was that "Foul air is air vitiated to a certain definite extent."

We have already noticed that air is vitiated by the extraction of oxygen by the lungs and the subsequent addition of carbonic acid, and also by the production of organic impurities. But in addition to that expelled from the lungs, carbonic acid and organic impurities are given off continuously by transpiration from the skin. The amount of the carbonic acid is about one-fourth or one-fifth of that exhaled from the lungs, while the organic impurities vary both in amount and character according to the activity or the state of feeling of the individual, and the exercise of varying emotions; so that, for example, a theatre will require more ventilation during the performance of a tragedy than a comedy, so also with a church. It is, however, hardly advisable to so plan our ventilation scheme that its regulation by an ordinary specimen of the genus verger shall depend upon the pathetic, joyful, or mournful character of the sermon.

The carbonic acid and the organic exhalations are not the only additions to the atmosphere made by individuals. A large increase of watery vapour is caused by the expiration of moisture from the lungs, and also by insensible perspiration from the skin. This added moisture vitiates the air in a twofold manner, first, by inducing more rapid decomposition of the organic impurities and the consequent formation of unpleasant and injurious gases; and, secondly, by hindering the proper evaporation from the skin, which is essential to prevent the unhealthy rise of the bodily temperature which we call fever.

Thus we see that air is vitiated by the changing of its oxygen into carbonic acid, by the addition of organic impurities, and by the increase of its humidity.

We have next to consider what degree of impurity can be admitted in the atmosphere of public buildings.

The amount of air expelled from the lungs and skin per minute is ·33 to ·35 of a cubic foot, and contains 4 per cent. of carbonic acid, while about 4 cubic feet of air are saturated with moisture by each person in the same time of one minute, so that a supply of 4½ cubic feet per minute for each individual would be sufficient, could we ensure that he would receive this fresh air, and no other each minute. To do this, however, it would be necessary to enclose each one standing in an upright case, with about 4 in. or 5 in. clear all round, and to admit the fresh air at one end, and remove it immediately when exhaled at the other. Only under these conditions would the supply of 4 cubic feet per minute be sufficient, as advocated by early writers on ventilation.

Air is, however, as our fifth lamp shows us, a gas, and hence is subject to the law of the diffusion of gases, so that the exhaled air at once mingles with the surrounding atmosphere, and is thus diluted and spread over a large area.

Although it is true that the carbonic acid is one and half times as heavy as pure air, yet the heat imparted to it by the lungs renders it lighter, so that it is rapidly diffused, and when once diffused no length of time effects the least settlement or separation.

Thus the air of any apartment will rapidly approach a condition of equable impurity, and the point which we must seek to elucidate is the extent to which air may be vitiated without becoming foul, that is, injurious to health or unpleasant to the senses.

We have seen that the exhalation both of

* A paper read before the Architectural Association by Mr. F. R. Farrow, on the 16th inst.

water vapour and of organic impurities is variable in the case of every individual and the circumstances of his bodily and mental condition; it is therefore usually thought advisable to take the amount of carbonic acid in the air as a test of purity, and as a general rule it may be assumed that the admissible amount of carbonic acid is twice that of the normal atmosphere, that is ·8 per 1,000 in volume. This degree of pollution will be attained in a continuously occupied room at the rate of 32 cubic feet per minute. In rooms occupied for a short time only, as in schools, churches, and chapels, a less supply of air is sufficient in practice, both because the cubic contents of the room will supply the needs of the inmates to a certain extent, and also because there is usually a continual leakage through windows, doors, and walls, and the occupancy of the room being for a short time only a greater degree of vitiation may be neither hurtful nor offensive, provided that the humidity of the fresh air be not excessive.

Dr. Reid, who devised the original system of ventilation for the Houses of Parliament, considered that under ordinary circumstances a well-distributed supply of 10 cubic feet per minute was ample.

In Germany the usual practice is to supply 10 to 12 cubic feet per minute for schools, 20 to 25 cubic feet for meeting-rooms, and 40 to 75 cubic feet for hospital wards.

The Austrians provide from 15 cubic feet for theatres and banqueting-halls, to 25 cubic feet for ball-rooms, council-chambers, &c.

In America from 10 to 30 cubic feet, according to the purposes of the room, are given, with an increase to 60 cubic feet in the case of hospitals.

These figures of course make no allowance for the vitiation of air by gas lighting, or other extraneous causes. Each burner requires 45 cubic feet per minute, which must be provided in addition to that supplied for the audience.

Our third definition was "Fresh air is air in a normal state of purity." Now by "normal state of purity" we must not understand the condition of the external atmosphere at any given moment in such a city as London, where the air is so frequently laden with that noxious compound which we call fog, and is always, more or less, impregnated with organic and other impurities, which we term dust. In a state of normal purity the air should contain 21 per cent. of oxygen, and 79 per cent. of nitrogen nearly, with ·4 per 1,000 of carbonic acid, and one fifty-millionth part of organic impurities. Such a measure of purity is, however, almost unattainable in a town atmosphere, but an approximation should be made thereto by washing the air with a waterspray, and filtering through cotton-wool.

Our fourth definition was "Draught is the unpleasant contact of fresh air with the person." This unpleasant contact usually produces the sensation of cold; but we must not forget that there is such a thing as an unpleasant hot draught, though it is neither so injurious nor so offensive as the cold draught, the bugbear of all ventilators, and the dread of the ventilated.

Cold draught from the incoming fresh air arises from four sources:—1, Over rapidity of current; 2, Lowness of temperature; 3, Too great humidity; 4, Too little humidity. Each of these causes produces the sensation of cold by lowering the temperature of the surface of the body, the first and fourth by causing excessive evaporation from the skin, the second by the increased radiation of heat from the body to warm the surrounding atmosphere, and the third, by the extraction of the corporeal heat to maintain the undue suspension of watery vapour.

Fresh air should never enter at a greater rapidity of current than 2 ft. per second, while a rate of 1 ft. per second is perceptible at the point of entry. Nor should the temperature for our climate and hygrometric conditions be less than 50° F., this being lower by 20° than is possible in America.

Cold draught may be caused not only by the incoming fresh air, but also by local currents induced by the cooling of the internal atmosphere and its consequent descent; these local currents are especially caused by skylights, windows, and open roofs, and their presence may often serve to condemn in the eyes of the public an otherwise carefully-planned and satisfactory system of ventilation.

The last three of our "lamps" or principles we may consider together, as they are intimately connected. "Air is a fluid and a gas," and is therefore subject to the laws of diffusion of gases and expansion of fluids, consequently "heated air is lighter than cold air of equal purity," and "foul air is heavier than fresh air of equal temperature." The consideration of these principles at once brings us face to face with one of the most important and most warmly contested points in ventilation, the position of the inlets and outlets for the supply of the fresh and the removal of the vitiated air. Are we to introduce our fresh air at the lower part of the hall and extract it at the top? or are we to bring in our fresh air at the top and take it out at the bottom? The different views taken of these questions have led to many a fight between the advocates of the upward and downward systems of ventilation. Let us examine the two methods by the light of our "lamps." The advocates of the downward system claim that foul air is heavier than fresh air, and therefore we should extract the foul air at the lower level, but we must remember that our principle is that foul air is heavier than fresh air of *equal temperature*, and if we look at the source of foul air we see that it is exhaled by the individual, whether from the lungs or from the skin, at a temperature of 90°, and therefore, except at this temperature, has *primâ facie* a tendency to rise in respect of its warmth, though there is doubtless a counteracting influence by reason of its impurity. Accordingly we conclude that foul air on its production has a tendency to rise, unless the difference in temperature between it and the surrounding atmosphere is insufficient to counterbalance the increased weight of its impurity. The point at which the weight of exhaled air at 90° is balanced by the weight of fresh air is at a temperature of 85° for this latter. If, then, the surrounding temperature is below 85°, the foul air commences to rise and will continue to rise until it loses so much of its heat as to render it specifically heavier than the normal atmosphere. During this ascensive process, however, it must not be forgotten that, as air is a gas, diffusion is taking place rapidly, and the foul air is therefore, while losing heat, losing weight also by the dilution of its impurities with the purer atmosphere. The impurities produced by gas-lighting are even more ascensive in their character, owing to the great amount of heat developed in combustion.

Therefore we can readily see that if fresh air be admitted at the top of the hall it will meet these ascensive columns of vitiated air and become itself adulterated before reaching the occupants, and this adulteration will be in a continually increasing degree until the air breathed by the occupants will be the most vitiated possible for any given supply of fresh air. The descending system has, however, advantages in the avoidance of draught and the equable supply of air to all parts of the room alike.

The universal system in Germany and Austria is to introduce the fresh air at the upper part of the room in winter and at the lower part of the room in summer, the extraction being in a contrary direction, so that the warm air in winter, cooling naturally, descends, while the cool air in summer, becoming heated, rises. This method and the argument in favour of it depend to a very considerable extent on a very high dew-point, so that there is a far greater chance of success than there would be here in England with a low dew-point.

In the case of a hall without ventilation there is a constant rolling stream of air passing upwards from the heating apparatus to the top of the room; then, cooling, it again descends on the other side of the hall, and so keeps up a constant circulation. Now if ventilation is introduced to such a hall and is insufficient to carry off the whole stream of heated air as it ascends, the roll of the atmosphere will not be wholly diverted, but will still continue, and thus there may be with advantage an extraction of air at the lower level. But this method of extraction can only be justified for adoption when artificial heating is abundant, and when no gas lighting is in use to vitiate and heat the upper strata of air. This will accordingly limit the effectiveness of the method to the day-time of a portion only of the winter months, and hence may, I consider, be practically inadvisable in our country.

To summarise the lessons we gather from a consideration of the principles of ventilation:—

First, we learn that our object in ventilating a public building should be to provide an adequate supply of fresh air, uncontaminated as far as possible by contact with foul air, which latter should be removed as speedily as may be; and, further, that an adequate supply may, in ordinary cases, be taken to mean from a minimum of 10 cubic feet per minute for each individual, rising to about 30 cubic feet, according to the use and circumstances of the building.

Next, we learn that draught must be avoided by careful regulation of the rate of current, temperature, and humidity of the fresh air, and that vitiation of the instreaming atmosphere will be best obviated by bringing in the fresh air at the lower part of the hall, and extracting the foul air at the upper part.

We have now to consider the best method of achieving the *desiderata* at which we have arrived, and the application of principles to practical work.

Our object is the introduction of fresh air and the extraction of foul air, and this object we must attain with certain conditions already formulated. There are three distinct methods by which our object may be attained,—(1) We may force in the fresh air, and allow the foul air to escape by the propulsive force of such fresh air; (2) we may draw out the foul air and allow the fresh air to enter and to supply its place; or (3) we may both force in the fresh air and draw out the foul air. Which of these three methods we should adopt must depend both upon the peculiarities of each individual case, and upon the means which we propose to employ to obtain our end.

These means may be divided into two classes, natural and artificial. By natural ventilation is understood that obtained by means simply of the natural power of air under certain conditions to produce and sustain motion. Artificial ventilation is the adoption of mechanical or other artificial agency to produce the desired currents of air.

Natural ventilation depends chiefly upon the difference in temperature between the incoming and outgoing air, if this difference be considerable the flow will accordingly be greater than when little difference exists. If some of the openings be exposed to the direct action of the wind, this will also tend to produce a current, and this is the operative principle in what is termed the "cross-ventilation" of hospital wards. The air pressure on two sides of a ward is rarely if ever equal, and hence if windows be open on opposite sides, a current will nearly always be maintained, and frequently a very strong current. Similarly, if there be two openings or two series of openings at the upper and lower part of a room or hall, a current of some kind will be almost always found to exist. Thus, we have in this way a very simple and cheap method of ventilation, but it can hardly be called desirable or satisfactory. The varying pressure, whether of the wind or of temperature-difference, will cause a constantly-varying rate of flow in current, so that if provision be made for ample ventilation when the current is sluggish, a swift current will produce an unbearable rapidity of change unless means are provided for reducing the area of the openings, but even then constant alteration will be required to meet the constant change of motion. The direction of the currents, too, will be always liable to sudden and unexpected reversal, and above all it is practically impossible to sufficiently regulate any heating arrangements to accommodate the varying exigencies of the moment.

Natural ventilation may be usefully adopted in private buildings, but for the large supply and other requirements of public buildings it is almost out of the question.

There is, however, one form of natural ventilation which may be with advantage employed in public buildings occupied for a short space of time only, and by a number of persons, small in comparison with the cubical contents of the apartment, that is, by a thorough freshening and renewal of the atmosphere during the times between the occupancy of the room; as, for example, in some schoolrooms, where the children are frequently sent out for a short space of time, when the windows and doors may be all opened, and the air freshened up for the next session.

Artificial or mechanical means of ventilation may be classed in three groups:—

1. Mechanical means, needing no attention, *i.e.*, self-acting.

2. Mechanical means, needing a small amount of attention.

3. Mechanical means, needing constant attention.

The first group of these are of varying character, but all depend for their action on the fact that air is a fluid, and for the most derive their motive power from the wind.

One of the oldest, and for a long time most trusted, of self-acting appliances is the so-called "syphon" ventilator of Charles Watson, which consists, as most of us probably know, of two tubes of unequal length, enclosed in the usual ugly casing so dear to ventilating tradesmen.

If all other openings into the apartment, as doors and windows, were closed, an upward current of the internal air was established in the longer tube, and a downward current in the shorter, similar to the action through the legs of a syphon, but not, mark you, by reason of the principle of the syphon, but from the difference of temperature of the air in the two tubes. In the event of any more ready access of the air, the apparatus simply acted as an ordinary natural outlet. The great success of this device can only be understood by remembering that it was the first substitute for no ventilation; for the evils of its action are apparent in the bold introduction of a cold descending stream coming directly down upon the heads of the inmates, and passing through, and consequently cooling and mixing with the ascending current of foul air. A cooler atmosphere was, of course, produced, but this we have already determined is not ventilation.

The next series in this group of self-acting ventilators are those various modifications of the "Archimedean screw" system rejoicing in the high-sounding titles of "Empress," "Imperial," and the like. These consist of a wind turbine connected to the upper end of a spindle whose lower extremity is furnished with screw blades, two or more in number; the turbine, acted upon by the wind, revolves, and with it the spindle and screw, by which a current is induced of greater or lesser intensity. When once erected these, of course, need no further attention until from the wearing out or rusting of the moving parts or increase of friction they come to a dead stop, but as their moving parts continually decrease in smoothness of working they rapidly lose in efficiency, and at the best are but feeble in their action except under strong wind pressure.

Our third series in this group have of late far distanced other competitors in the field of "self-acting" ventilators. They are based on the principle of the kinetics of a fluid across the mouth of an open pipe, and their effect can never be greater than would be obtained by a simple open pipe provided that the stream of crossing air always passed in a favourable and equable direction; but as this is, under the circumstances, never experienced, means have been devised in the construction of mechanical appliances of this kind to provide for the regulation and direction of all wind currents in the desirable course.

Two well-known typical examples of this series will suffice to enable us to understand the general principles,—Banner's cowl and Boyle's so-called "air-pump" ventilator. Banner's cowl consists of a horizontal trumpet-mouthed tube, arranged with a wind-sail, so as to revolve over the mouth of a vertical tube, in order that the wind may be always received in the conical mouth, and directed horizontally across the mouth of the open tube. Nothing could be simpler and nothing more effectual, as long as the cowl revolves freely and the wind blows.

Boyle's ventilator has no moving parts, but consists of a skilful arrangement of curved plates and cross diaphragms, so disposed as to divert any wind-current into such a direction that the principle we are considering may come into operation.

We are, doubtless, most of us aware of the wordy strife which has been waged between the partisans of these last two inventions; but, looking at it dispassionately, we may fairly admit that each is logical in its idea and efficient in its action. Personally, of the two, I prefer Boyle's ventilator, because it has no moving parts to get out of order, and is more easily enclosed in a turret or flèche, to obviate the fearful ugliness from which all these devices suffer.

I do not propose to weary you with descriptions of the numerous modifications of these types, of which there seems to be an increasing supply every month. If we do but rightly understand the principles involved we shall be able to judge for ourselves of the respective merits and advantages of each for our particular purpose, and to decide which will in any one case give the best value for our client's money.

We should, however, consider the peculiar advantages and drawbacks of the group of "self-acting" ventilators. As we have seen, they depend upon the wind for their primary motive power, and hence they are, naturally, irregular and spasmodic in their action; for instance, in the experiments made by Professor Corfield, Mr. Rogers Field, and others, on Boyle's ventilators at the Custom House, it was found that on two successive days the extracting action of the 3 ft. ventilators varied from 1,347½ cubic feet per minute on the first day to to 535 cubic feet per minute on the second. Such variation as this at once shows the great difficulty of using any "self-acting" ventilator where satisfactory ventilation is aimed at. Not only will there be an ever-varying speed of current, but the heating arrangements will require special provision to meet this variation, and must, therefore, be adapted for a large reserve of power. Some current will almost always be attainable unless the moving parts are checked by friction, dust, or wear, as the movement of the air is very rarely less than six miles an hour, and averages twelve miles an hour.

Our next group of mechanical contrivances are those which are not self-acting, but require a small amount of attention.

The first class in this group consists of those arrangements for supplementing the action of natural ventilation by the creation of an artificial difference of temperature by means of columns of air rarefied by adventitious heat. For example, we may adopt a large flue with a heating furnace at the bottom, and into this admit channels from the apartment to be ventilated. Similarly, the use of a series of gas-jets or of hot-water coils will induce an artificial current, and are usually of easier application than a regular extraction-flue. Arrangements such as this have the advantage of far more equable and certain action than those of the first group ("self-acting" ventilators), and it is possible to make a calculation of the effective power that can be attained by the consumption of a certain amount of heating power which shall be fairly near the truth. These devices are, however, occasionally liable to failure when severely tested by strong and sudden gusts of wind or cold air unless provision be made for such contingencies.

The whole of the types we have already noticed are, you will have observed, adapted only as exhausters, the foul air being drawn out by these means, while fresh air is allowed to enter by suitable inlets, and with proper provision made for warming the same on admission to the apartment. The methods of warming the fresh air are almost numberless, and may consist of close stoves, hot-water or steam pipes, gas stoves or ordinary fireplaces, as may be best adapted to the particular case in question.

The remaining mechanical means of inducing currents both in this and in the third group, may be applied either as exhausters or injectors.

Thus in this group we have first those mechanical aids, which consist of arrangements for driving fans by means of water-power. This type of apparatus comprises a horizontal turbine, fixed at one end of a spindle, with fan blades at the other. The spindle revolves on accurately-fitted centres of hard material, as phosphor bronze, and are supplied with ample lubricating boxes; the turbine is driven by the impact of fine jets of water, and thus works the fan.

Verity Bros.' patent ventilator is a good example of this type of apparatus, while another, called the Aërophor, is being introduced from Germany by the agents of Messrs. Treutler & Schwarz, of Berlin. The results and the cost of both these inventions are very nearly equal. Messrs. Verity's apparatus works with a pressure of 35 lb. to 50 lb. on the square inch, and their medium size with the consumption, or rather use, as the water is not wasted, of ten gallons an hour propels from 350 to 450 cubic feet of air per minute; with smaller pressure, of course, a larger amount of water must be used to obtain similar results. The Aërophor is rather cheaper in first cost, especially in the larger sizes, than Verity's patent, but requires a rather larger amount and higher pressure of water to obtain equal power. Where a constant supply of water is provided, this type of apparatus may well be employed, as the pressure in the mains is usually about 60 lb. to the square inch, otherwise the requisite pressure must be obtained by the use of cisterns.

These appliances have many advantages, from the small amount of attention they require, the simplicity of their working, and the ease with which they can be regulated or stopped at will, the turning of a stop-cock being all that is needed to start or regulate them. Their disadvantages are the liability to failure during frost for want of water and the small amount of power attainable, the largest specimen ever made by Messrs. Verity being an extractor of only 4,000 cubic feet a minute, and the largest stock size of the Aërophor exhausting only 3,000 cubic feet a minute, with 120 gallons of water per hour.

Another instance of the employment of water-power for inducing current is seen in the "Aeolus" waterspray ventilator, though in this case there is no moving mechanism, but simply a conical spray shower of water from a downward vertical jet under considerable pressure, which, acting within a tube, causes a corresponding downward current of air. Thus, the action is simpler even than the turbine ventilators, while the consumption of water is naturally greater, and the full power is not great, the largest size extracting 5,000 cubic feet a minute, with 200 gallons per hour at 45 lb. pressure.

We now come to the third group of mechanical means, those which require constant attention. These universally consist of rotary fans driven by steam or gas engines, and so needing a continual attention. I do not propose to go into the question of the merits of various forms of fans, still less into the consideration of the different types of steam or gas engines, because firstly, these are strictly within the province of the mechanical engineer; secondly, because to take up this branch of the subject thoroughly would of itself occupy a long evening; and, thirdly, because there is very little difference in the comparative effect of different forms of fan for any given horse-power. Our province is to consider what are the necessary requirements of the ducts or air-passages, their form and their dimensions. The desirable rate of flow for a forced current in a main channel is about 600 ft. a minute, while the inlet or suction air-passage to a fan should have one and a half times the area of the outlet or distributing duct. To compensate for resistance of air in passage along the channels, and yet to preserve the smallest efficient areas of distributing ducts and passages, their sectional area should be increased by $\frac{1}{400}$ for every foot of distance from the fan, added to a constant increase of one-fourth for each square foot in area of the main channel to allow for the great resistance of small passages.

The air-channels must be exclusively devoted to their purposes, and should not be used or even be made so as to be available for passages. They must be clear, unobstructed, and smooth, with all angles rounded, all corners filled in, and all enlargements avoided, so as to present the least of resistance to the flow of air.

This third group of mechanical means is, of course, by far the most preferable where the expense both of first cost and of maintenance can be borne, and it is indeed the only way of providing a thoroughly sufficient and efficient scheme of ventilation for a large or complicated public building.

We have now glanced at the various types of apparatus which we may employ to force the fresh air into our hall or to expel it when vitiated. We will now consider a little further the advisability of using any one of the three methods of directing a current which we saw to exist, *i.e.*, whether it is better to force in the fresh air or to force out the foul air or both.

One point we must never forget: whichever method we adopt, we must have both inlets and outlets, separate and distinct, and without any doubt as to which function they discharge. So many of the public have an idea that if they have an exhausting apparatus at work, the fresh air will come in somehow and somewhere. It will undoubtedly, to a certain extent, through windows and doors, in fitful gusts and piercing draughts.

Many of the mechanical means we have discussed are, as we saw, adapted only as exhausters, and, therefore, if we use them, we shall probably simply supplement them by free inlets for the fresh air without injecting power. This method has the great advantage of easy applicability. It is such a simple thing

ust to put up an exhauster and knock a few holes in the wall for the fresh air to come in as it listeth. But there is with this method the great drawback that the inlets will not be at the same distance from the exhaust, and, moreover, will be subject to different atmospheric pressure according to the direction of the wind, with the result that the entry of the fresh air will be greater at some points than at others, and, moreover, will be changing and fitful according to the varying circumstances of the inlets. If the exhaust system be adopted care must be taken to neutralise, as far as possible, the tendency to unequal action of the inlets.

Suppose, however, that we force in the fresh air and allow the foul air to pass out merely by the propulsive force of the entering air, what is the result?

We shall be able to maintain an equable, well-distributed, and regular stream of inflowing air, but our outlets will be liable to be more or less overpowered by great difference of temperature or strong wind pressure, and this will especially be the case if the outlets are too large or too numerous, points which must be carefully attended to, together with the adoption of carefully-planned baffles for the wind.

Thus we see that both of these methods are liable to cause draught, from the peculiar dangers to which they are each exposed, and we therefore come to the conclusion that if our scheme of ventilation is to be relied on to give satisfactory results we must employ both of these methods,—we must both force in the fresh air and force out the foul air. Of course we may possibly often use for one of these purposes, especially for the expulsion of the foul air, means which are not altogether satisfactory in themselves, but will give good results when combined with good impulsive power.

The question of the position of inlets and outlets we have already touched upon, as regards the direction of the current, but it is important to remember that other points in relation to the openings demand our attention. The rate of entry of the fresh air will, of course, decide the area of the inlet openings, but this area should be subdivided to the fullest extent, and distributed as evenly as possible throughout the apartment. On no account should the stream of fresh air be able to enter in a mass, and pass compactly through the hall, for if so the parts of the atmosphere out of the direct stream will be stagnant, or nearly so, just as one sees in a mill-pond where, in spite of a swift current through, the corners are almost quiescent; for, remember, air is a fluid as much as water is.

So important do I think this equable distribution of the inlets that I personally believe it is better to endure the disadvantages of floor-gratings rather than have the currents at the sides of the room only. Here is one of the advantages of the downward current arrangement, as the air can be evenly distributed without the disadvantages of gratings.

It is preferable that the direction of the openings should be in all cases vertical, as horizontal entry of the air is very apt to cause troublesome local currents of greater intensity than the fresh-air flow, and thus produce the ever-dreaded draught.

A capital device for preventing draught is the constrnction of a sub-hall, in which the fresh air can be both properly prepared and warmed, so as to be quite ready to enter the main apartment. Here the draught, if there be any, will be expended, and the fresh air enter in an even and regular flow.

The different means of heating the fresh air would take too long now to describe, but it must be remembered that the fresh air should always be warmed when needful before entering, or immediately on entering, the hall, so as to prevent the feeling of draught. Warming a building by a current of warmed air, which speedily is expelled as foul with a scheme of ventilation, is, of course, more expensive than the usual heating and re-heating of one body of air only, but if the public are to have ventilation, they must be prepared to pay for it, and this loss of heat is merely one item of the cost.

I have thus endeavoured to bring before you the rudiments of the science of ventilation, and to enunciate its governing principles. The application of these principles will vary in almost every case, and each of us must decide for himself what is the best method of dealing with any particular building with the means at his disposal, and this may, with care and experience, be well accomplished without placing ourselves at the mercy of the sanitary tradesmen, and allowing them to place forests of pipes and other monstrosities in the most conspicuous position.

[Mr. Farrow at the close of his paper explained some drawings exhibited on the walls. One was a plan of the Rathhaus in Vienna, showing the ventilation of a large ball-room capable of accommodating 3,000 persons. The ventilation scheme is divided into two equal and similar halves. The fresh air enters the cellar, and is driven by fans along passages in the basement. It then enters several heating-chambers, in which the air is warmed by contact with steam-pipes; it passes upwards through a large vertical shaft to the roof of the ball-room, and falls on the heads of the inmates at the rate of about 1 ft. per second. The foul air is extracted by several shafts let into the cellar and is expelled by another fan. A similar plan of ventilation is adopted in the Banqueting Hall. Mr. Farrow also explained the ventilation of the Vienna Opera House, and of several works in this country on which he had been engaged.

For a report of the discussion which followed, see p. 151.]

## Illustrations.

### DESIGN FOR THE COMPLETION OF THE HOUSES OF PARLIAMENT.

WE give this week a view of the completion of the Houses of Parliament as intended by Sir Charles Barry, a scheme to which considerable reference was made during the recent sittings of the committee on the "restoration" of Westminster Hall. It was then stated by Mr. C. Barry that plans by his father were in existence for an extensive addition, commencing at the clock-tower and returning along the line of St. Margaret-street, which it had always been his wish to see carried out at some future time. Plans for this addition were made by him, and a view of the proposed addition is given as a plate in Dr. Barry's "Life" of Sir Charles Barry. The present view has been drawn afresh from those plans and the elevations and sketches existing. Some modifications, however, have been made by Mr. C. Barry. The plan, which we published a few weeks ago (December 13) is drawn more inwards, towards Westminster Hall, at the southern end, so as to leave St. Margaret-street wider at that point; the original plan would have left rather a narrow gut in the roadway at that point. The crowning feature over the gateway is altered from a small lantern, as in the original design, to a larger octagon lantern, raising the centre, which was formerly rather depressed between the two flanking towers.

The original design was made at the time when Sir C. Barry foresaw the probable removal of the Law Courts at no distant date. It thus represents what he would have regarded as the best use to make of the space, architecturally and practically, whenever that removal took place. He was well aware that greater space would eventually be required for rooms and residences in connexion with the Houses of Parliament, and, in fact, the space has been required long before now, and many outstanding offices are in use, at heavy rentals, to supply the defect of space in the Westminster Palace. Mr. C. Barry calculates that the money thus expended annually is considerably greater than the interest on the outlay which would be necessary to erect the new buildings as here shown; an argument which, to our remarkably economical Government, will probably be stronger than anything that could be urged in regard to architectural effect or completeness, and from our point of view also that is in one sense the strongest or at all events the most unanswerable argument in favour of at least giving full consideration to this scheme at the present moment. Other things apart, we should not desire to shut Westminster Hall out from sight; but seeing that so much more room is really wanted (and that want will go on increasing) it is surely more in accordance with reason and common-sense to provide for this by completing the great building according to its architect's intentions, than to provide a few paltry rooms between the buttresses of Westminster Hall, and leave the rest to be found on the system of rabbit-burrowing in offices about the neighbourhood. To carry out this scheme will be doing the thing once and for all, in a way worthy of the nation, and, if Mr. Barry's calculation is right, at an ultimate saving of money. If there is difficulty about the immediate expenditure, or if it is concluded that this gives more room than is wanted at present, the completion would be quite capable of being carried out in two instalments; half now, half when ultimately required.

The First Commissioner of Works suggested lately that some of the present buildings now used as residences might be taken for Committee-rooms, and residences provided elsewhere. In that case, the block fronting St. Margaret-street could very well be made the residential portion, and would be very suitably situated for that purpose.

The view is taken from the end of Great George-street, and shows as the prominent foreground feature the great gateway at the angle of new Palace-yard, which would form the grand entry to the precinct of Parliament. Sir Charles Barry proposed (and his son seconds the proposal) that this tower-like mass of building containing the gateway, with its octagon lantern rising above, should be named "The Albert Tower."

### DESIGN FOR A GATE-HOUSE AND BRIDGE.

WE give the design by Mr. E. Guy Dawber for this subject, which obtained the 10*l.* prize at the Royal Academy. It is a good "Mediæval" bridge, and as such does credit to its author, but we would rather have seen an attempt to deal in a picturesque manner with a bridge built more upon the lines of modern engineering.

### BAPTISTERY AND FONT, ST. MATTHEW'S CHURCH, BAYSWATER.

THE baptistery, font, and cover were given by the late Archdeacon Hunter to the new church, erected on the site of the old one in St. Petersburg-place.* The baptistery is formed by an apsidal extension to one bay of the nave, and is vaulted in stone, the moulded ribs being supported by detached shafts. The font is of Caen stone, with shafts of polished Devonshire marble. The cover is of American walnut suspended by a chain from the central boss of the vaulting; the weight, of globular form, rests just under the gas corona. The work was executed from the designs of the architect, Mr. John Johnson, of Queen Victoria-street, Mansion House, by Messrs. Dove Bros.; the carving being by Mr. Lawlor and Mr. Baird. The windows are filled with stained glass by Messrs. A. L. Moore & Co.

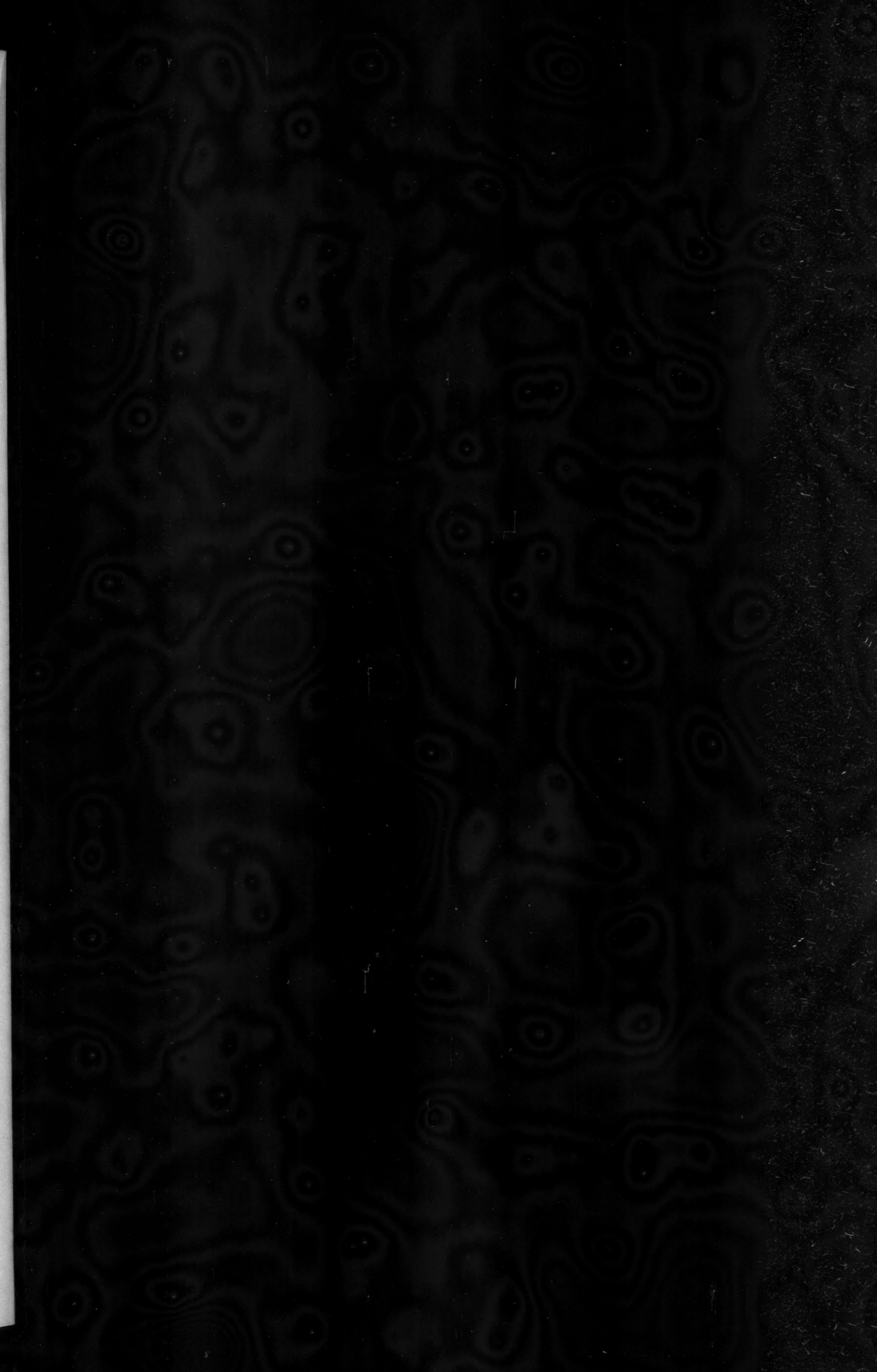
## COMPETITIONS.

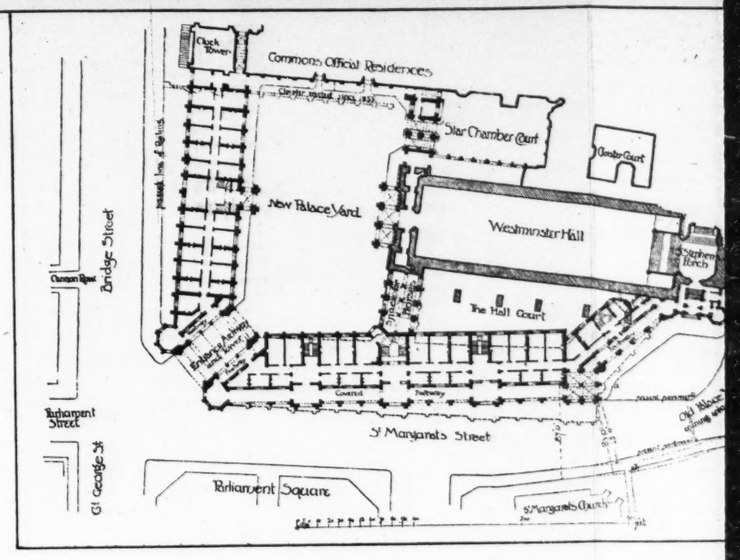
*Newbury District Hospital.*—No fewer than 120 sets of plans were sent in in this competition. Mr. Waterhouse, A.R.A., spent some time in examining them, and has selected eight from which to give his final judgment. The following is the list of the eight designs so selected (mottoes were optional), viz., those sent in by Messrs. Webb & Tubbs, of Reading; Mr. W. H. Woodroffe, of London; Messrs. Gordon & Taylor, Mr. H. G. Turner, Mr. J. B. Phillips; and those bearing the mottoes "Sunshine," "Economy," and "Plan" *in red.*

*Upper Bourne Estate, Bournemouth.*—The competition for laying out the Upper Bourne Estate, near Bournemouth, for the Poole Town Council has been decided. The design "Spero," by Mr. Barnes, architect, of Poole, is placed first; and those bearing the mottoes "Au Bon Droit," by Messrs. Habershon & Fawckner, architects, of London, and "Quod Petis Hic Est," by Messrs. Kemp-Welch & Pinder, architects, of Bournemouth, are bracketed second, and considered to be of nearly equal merit with the first.

**Nottingham.**—Mr. W. H. Radford, Assoc.-M. Inst.C.E., &c., has resigned his appointment as assistant engineer to the Nottingham Corporation, and has commenced private practice at Pelham-chambers, Nottingham, as a civil and sanitary engineer and architect.

* A view, plan, and description of the church were given in the *Builder* for April 7, 1883. We regret that on our present illustration the title is misprinted "St. Matthias's Church."



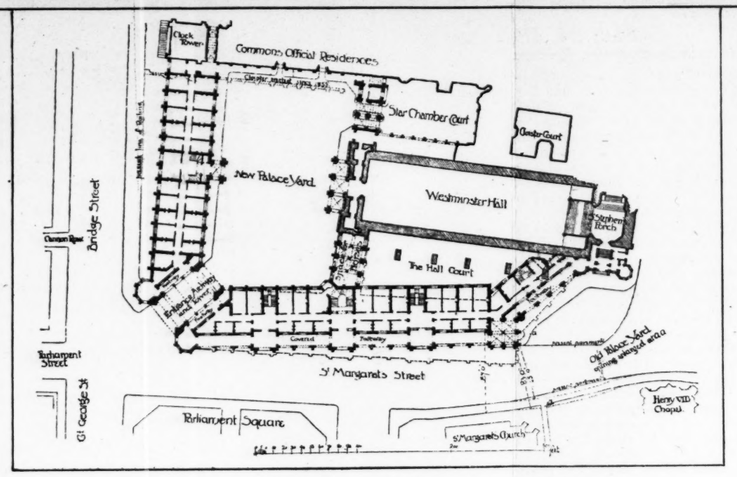



Wyman & Sons, Photo-Litho.

# DESIGN FOR THE COMPLETION OF THE HOUSES OF

BY THE LATE SIR CHAS. BARRY, WITH SOME MODIFICATIONS BY MR. CHAS. BARRY.

*View from the End of Great George Street.*

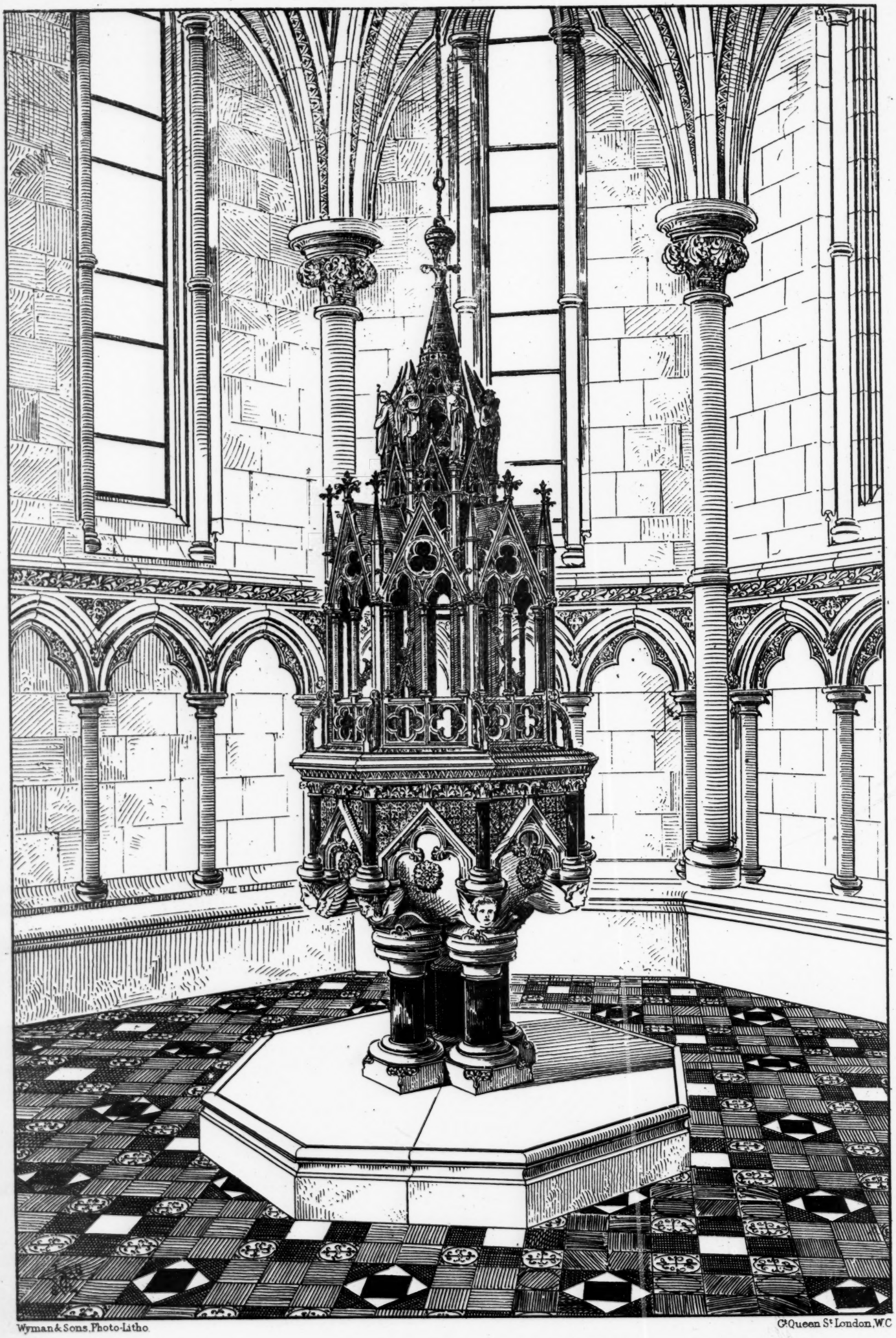



C. Queen St. London. W.C.

# DESIGN FOR THE COMPLETION OF THE HOUSES OF PARLIAMENT.

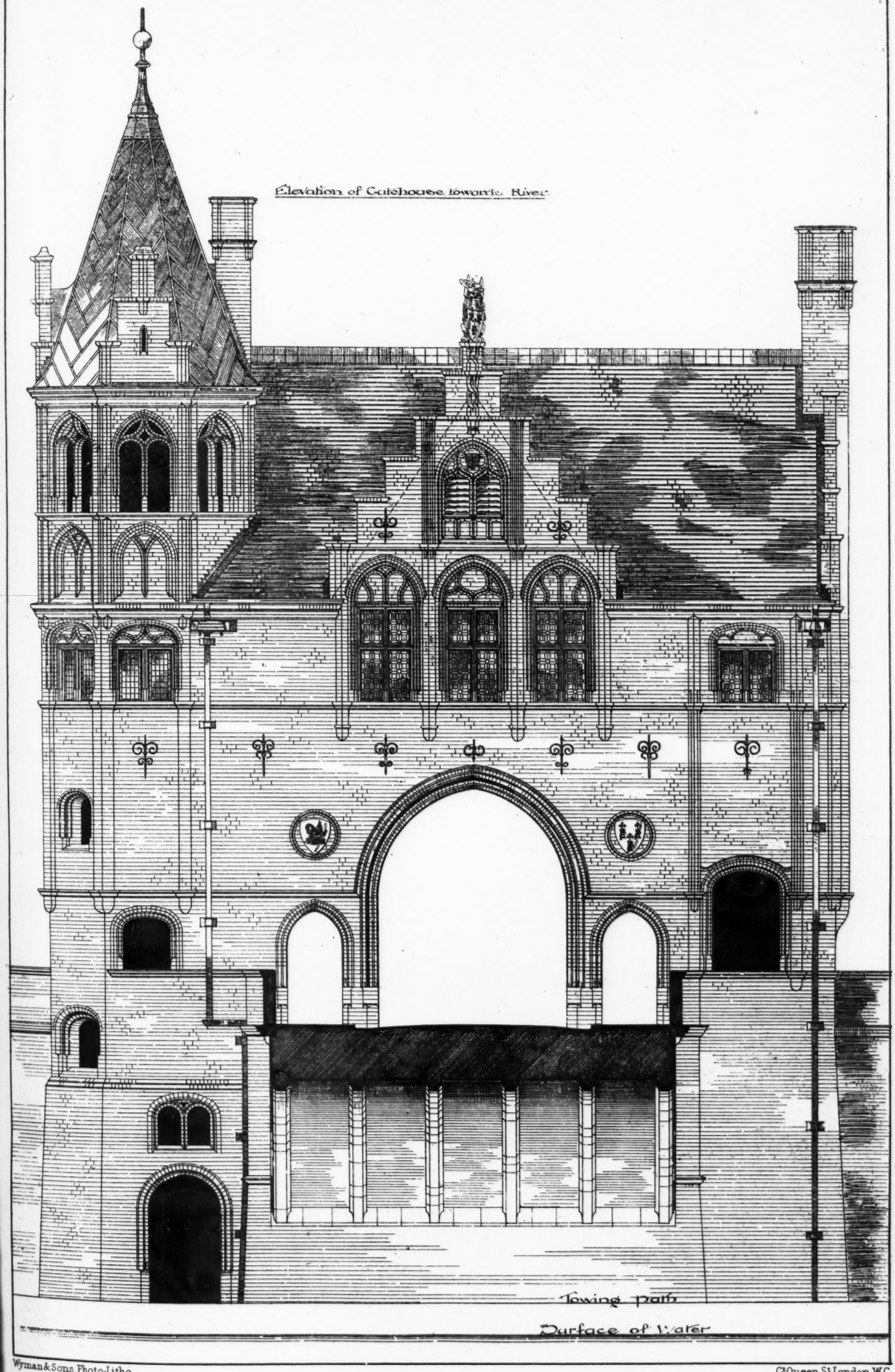
BY THE LATE SIR CHAS. BARRY, WITH SOME MODIFICATIONS BY MR. CHAS. BARRY.

*View from the End of Great George Street.*



Wyman & Sons, Photo-Litho. 6 Queen St London, WC

BAPTISTERY AND FONT, ST. MATTHIAS'S CHURCH, BAYSWATER.——Mr. John Johnson, Architect.

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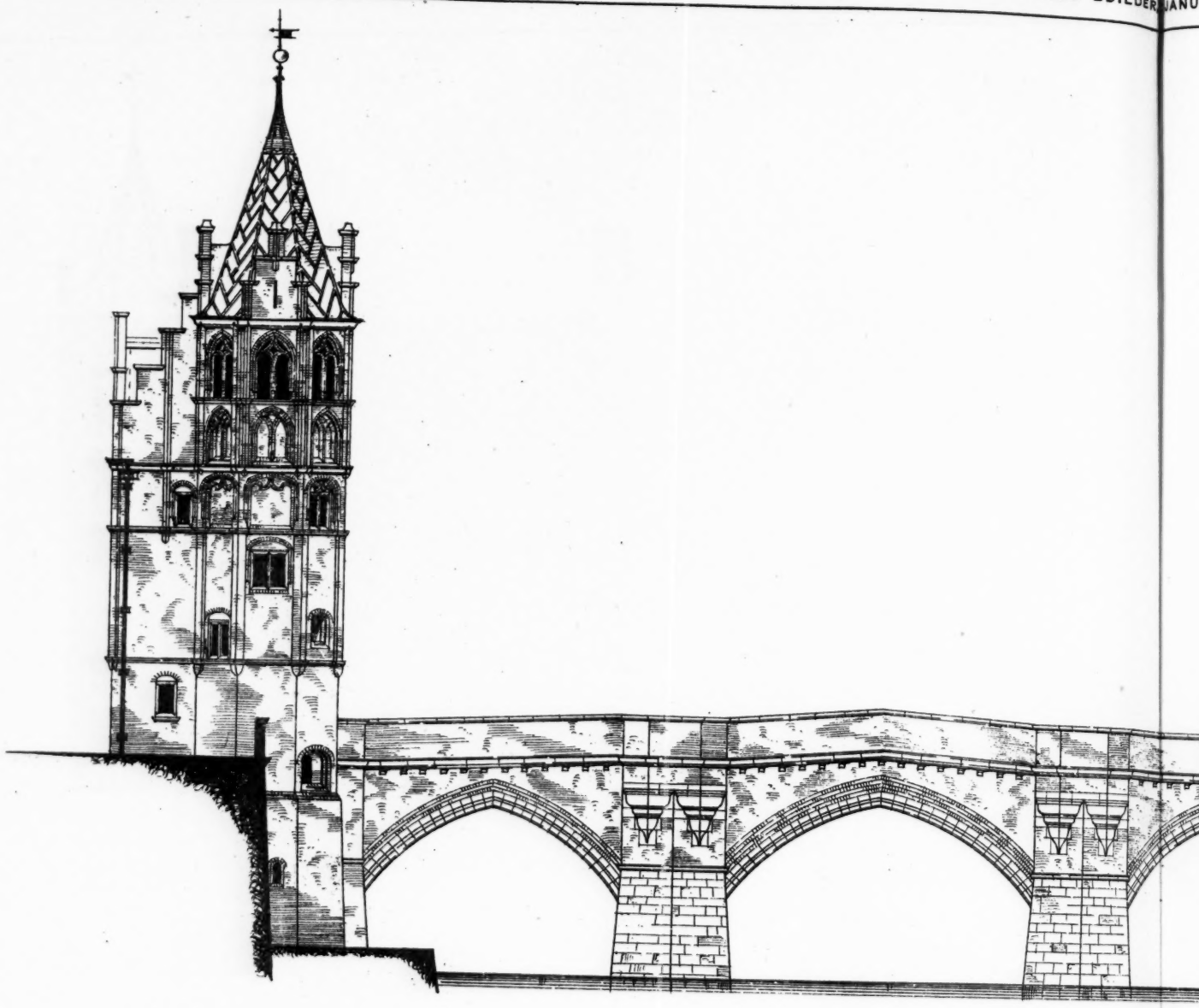
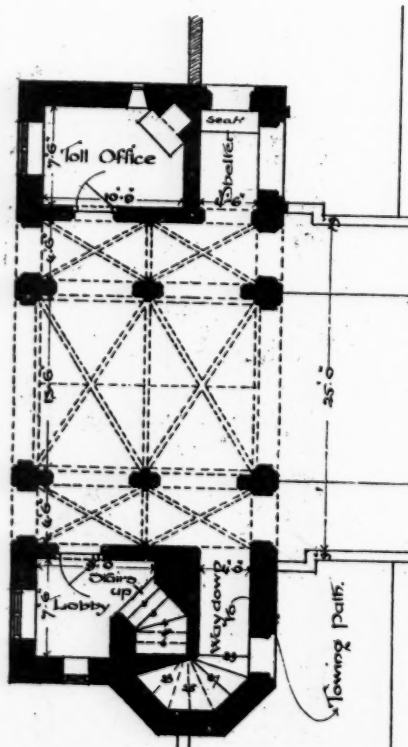
DESIGN FOR A GATEHOUSE AND BRIDGE.—By Mr. E. Guy Dawber.

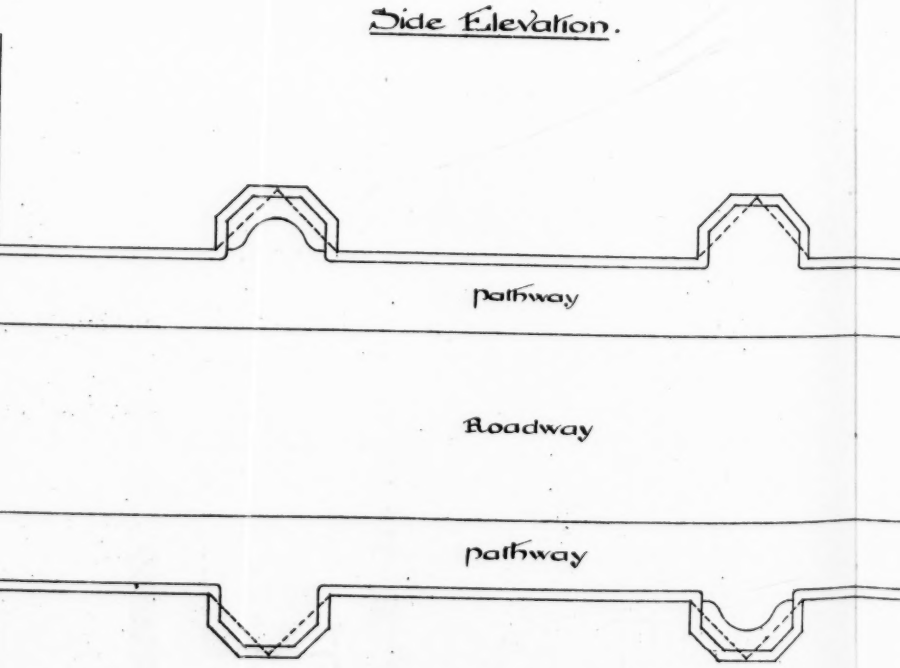
Royal Academy of Arts £10 Premium, 1884.



Side Elevation.




~ Ground plan. ~




Plan of Bridge.

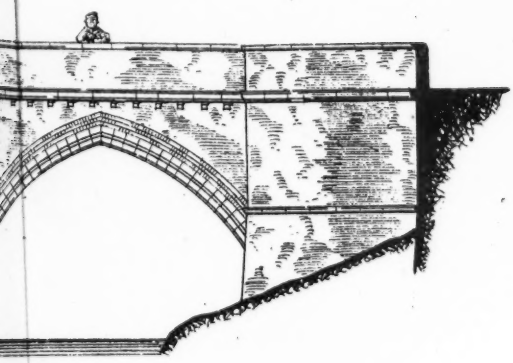
Scale. ~

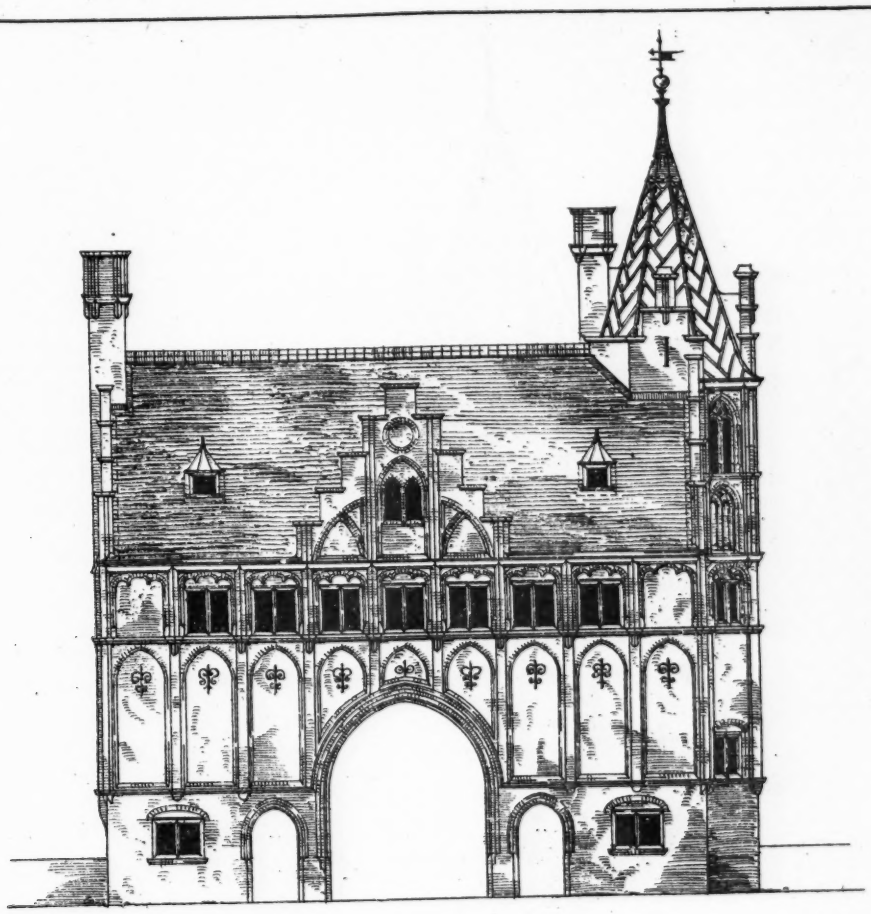
feet 10 5 0 10

Wyman & Sons, Photo-Litho

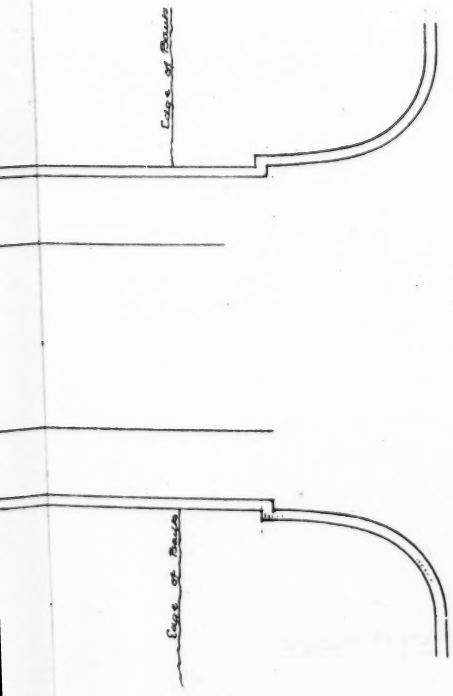
DESIGN FOR A BRIDGE AND GATEHOU

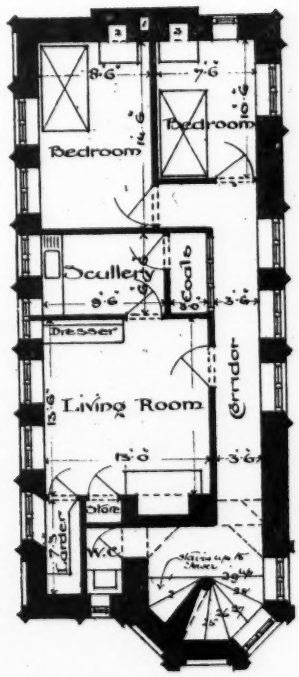
ROYAL ACADEMY OF ARTS



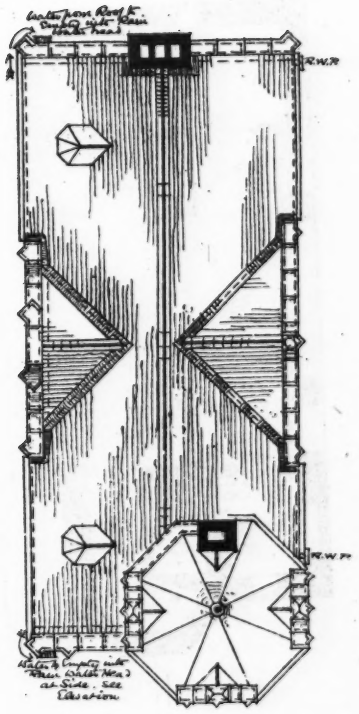


Elevation towards Town.




First Floor Plan.



Roof Plan.

Scale.
0 30 40 feet

C. Queen St. London, W.C.

GATEHOUSE.—By Mr. E. Guy Dawber.

ARTS £10 PREMIUM, 1884.

## THE FIREFROOF CLOSING OF OPENINGS IN PARTY-WALLS.

ROYAL INSTITUTE OF BRITISH ARCHITECTS.

THE ordinary meeting of the Institute was held on Monday evening, Mr. Ewan Christian, President, in the chair.

The Chairman referred in feeling terms to the loss the Institute had sustained by the decease of Mr. John Whichcord and Mr. R. M. Phipson. Remembering the interest taken by Mr. Whichcord in the success of the Architects' Benevolent Society, it seemed to him that nothing would so well tend to keep his memory green as the founding of a Whichcord Fund in connexion with the Society. In this memorial both young and old might unite, as the fulfilment of the object Mr. Whichcord had had so deeply at heart, viz., of increasing the funds of the Society over which he presided.

Professor Kerr said that two of the professional papers in referring to Mr. Whichcord's decease had suggested that his presidency of the Institute was in some sense unpopular. It would be a great mistake if that statement were permitted to go uncontradicted. It was the fate of Mr. Whichcord, as President, to be, as it were, the first of a new dynasty. Circumstances had caused some difference of opinion, but beyond that Mr. Whichcord's presidency was highly esteemed by the Institute. Mr. Whichcord was a man of cultivated mind, of remarkably powerful intelligence, and of great experience of the world. It was his destiny in his profession to assume the position identified with the name of a purely practical man, and he came before them, as the recipient of their honour, in that light rather than as an artist and scientific man, which he might with a good grace have pretended to be. No one understood better the functions of a chairman,—to promote freedom of debate, and to arrive at the real sense of the meeting.

Mr. Hansard remarked that Mr. Whichcord was one of that band of brethren, of which Professor Kerr was another, who met at Mr. Ashpitel's somewhere about 1857, and who propounded the first idea of a diploma for the Institute.

Mr. J. Macvicar Anderson (Hon. Secretary) also bore testimony to the value of Mr. Whichcord's opinion and judgment in difficult and intricate matters.

Mr. W. H. White (the Secretary) announced that the Council had awarded the sum granted under the Pugin Studentship for last year to Mr. Sankey. An examination of the sketches displayed on the walls would show that the Council had been justified in the course they had taken. It was further intimated that the sketches would remain on the walls for a few days.

Mr. Wm. White, F.S.A., then read a paper on "The Fireproof Closing of Openings in relation to the Metropolitan Buildings Act." After some brief preliminary observations, Mr. White came to the discussion of the main subject, consisting of three essential parts, the material of the door; its fittings; and the arrangement of the opening. (1) For the material of the door, iron still held its own. It was not altogether free from perils of its own, but on the whole it was the safest. Mr. Brannon's concrete doors on iron wire lattice frames were admirably suited for fireproof purposes. Wood itself was one of the best non-conductors, and when thoroughly encased in plaster or sheet iron its resistance was remarkable. An oak door, double planked with metal or asbestos, would be very safe. A solid oak door of 3 in. or 4 in. plank, even without extraneous protection, was said to resist almost any fire, provided its edges were well protected. He did not know whether the merits of cyanite or asbestos paint on deal doors had been duly tested. But the door prescribed by the Act was of wrought iron, the thinnest panel of which was not to be less than ¼ in. thick; hence it was commonly a sheet of iron riveted on to a skeleton framing of the same thickness, dividing it into two or more panels. The possible perils incident to this construction were pointed out, but it was owned that in many serious cases the thickness of iron provided by the Act had sufficed; still, it might often be well if the metallic shield were thickened out. Something might also be done by a contrivance for automatic closing of doors on the outbreak of a fire. Whether iron were the best material or not, it was at present the only one required or allowed by the Act. (2) The Act required the iron doors to be fitted into a rebated frame. There must not merely be a rebated frame for the door to be hung in, but it must be so fitted that no space must be left anywhere round the edges; thus no draught must be able to pass, and no heat, save by conduction and radiation. The first effect of the great heat upon the iron would be to so expand it as to fix it in its framework and make it still more impermeable. Mr. White said he had been told by Mr. Aston Webb that on two occasions of a fierce fire in the smutting-room of a mill at Deptford, which was thoroughly burned out, the ordinary iron doors fitted in this manner effectually resisted the communication of the fire to the adjoining division of the building, although in each case one of the doors was found to be warped out of its rebate. This, doubtless, took place in cooling, when the worst of the danger was passed. As a construction exactly answering to one not meeting the requirements of the Act, and one not more satisfying the wants of those who on their own account might naturally be thought to wish to adopt a reasonably fireproof system, were adduced the doors separating the different buildings lately destroyed by the great fire in the Queen's-road, Bayswater. (3) Coming now to the third point, Mr. White remarked that the facilities afforded for the spread of fire were largely and dangerously increased by the great and improper number of openings in each divisional wall. By means of these openings each story became practically a huge horizontal warehouse, without any fireproof separation in its height, and accordingly with a succession of seven distinct risks, arising from the seven portions into which the building was nominally separated. On each of the five stories were two openings in each party-wall dividing the several structures. Thus in each party-wall there were ten openings instead of one, and they were told that nobody was responsible for this state of things except the luckless depositors, who ought to have made a personal inspection of the premises, or possibly obtained a professional opinion on their construction before risking their property there. It was not for him, said Mr. White, to give an opinion as to who was responsible for so scandalous a state of things, but he was very greatly astonished to be told there is a serious question as to the number of openings allowed by the Act in any one party-wall; he was told that District Surveyors generally take it for granted there is no restriction. He knew that some who had studied the Act very carefully were of the same opinion. Against this laxity of interpretation he argued very earnestly and at considerable length. After all, however, it seemed to be undeniable that there were really no means of enforcing these provisions of the Act. No penalties were attached to its evasion in these respects. There was no Government Commission, and no system of inspectors to watch over its enforcement, as in the case of the Factory Acts. Again, the Act merely spoke of a building "used,"—not "hereafter to be used,"—and so the condition could not be enforced till after its occupation, the restriction would not apply till after the granting of the District Surveyor's certificate, leaving the owner or occupier free to use it in any way he might see fit. If this should be so, indeed, it was a case for immediate legislation, or, at any rate, for administrative reform. It would be well if in the case of these huge warehouses matters could be put on a better footing for the protection of the public. In respect to dwelling-houses, care was really taken, the District Surveyor having power to get a magistrate's order to stop or even to take down improper work. In theatres, personal safety had not yet been really secured by the compulsory provision of due means of exit in the event of panic. He, however, had done his duty in calling attention to necessary reforms.

Mr. Woodthorpe, in opening the discussion, said that there were many defects in the Act, as in all Acts of Parliament. There was a difficulty with regard to the definition of the term "public building," and the question of the construction of the doors was capable of improvement. At the same time, they had to thank Mr. White for bringing the matter before them so ably. The Act in its present form had succeeded well in many instances where the fires were moderate; but in cases where the fire was great, it was difficult to find anything that would help to stop it. The flames generally spread, not through the door, but by attacking the roofs. One very weak point in the Act was the fact that there were no means for compelling the closing of the doors. If this were done in the early part of the fire, it would be found very effective, and a heavy penalty should compel this to be done. In the present state of the law, the District Surveyors did the best they could, and in the face of divided opinion there was great difficulty in carrying out the terms of the Act. He agreed that the Act could easily be amended, and considered that amongst other things, the party-walls between warehouses should be carried higher.

Mr. Jennings remarked that Mr. White seemed to imply that District Surveyors had not done their duty. The District Surveyor had no positive power in himself, except to take a case before the magistrate. With respect to the question of the iron doors, the Act did not say how they should be hung. It said that they should be the distance of the thickness of the party-wall apart, consequently they could not be fixed in the party-wall. According to the strict wording of the Act, he believed they must be on the outside of the party-wall, unless it were thickened as now required by the Fire Offices. Therefore as far as the Act was concerned, it was not requisite to put the door in the exact way Mr. White spoke of. As regards double doors, these had been successful in almost every case. He was present at the fire in Duke-street, when one of a pair of iron doors was opened to have a look at the other, which was found to be perfectly efficient. The requirement of double-doors was most essential for the prevention of fire spreading from one building to another, but, as Mr. Woodthorpe had said, there was no provision for their being kept closed. Indeed, in order to compel this to be done, they would require the services of a police force to examine the doors. In his experience of fifty years he had never met, a single instance in which the fire had passed through a properly-built 9-inch wall. The great cause of the spread of fire was the putting of timber into the wall, the heat being sufficient to burn the ends of the timber and so communicate the fire. At the present time a large number of additions and alterations are made by persons cutting into the party-wall, sometimes without knowing they have gone through the wall. He did not think the Metropolitan Board of Works had much power to interfere. They considered they had the power of disapproving of public buildings not built in accordance with the Act, and yet he found they had allowed a wooden staircase in a church where 20,000*l.* had been spent on decoration. He hoped architects generally would take some steps to provide for further security against fire. The public had not much ground of complaint, as they could always insure their goods.

Mr. Robert Walker considered that Mr. White had been severe, not only on architects and District Surveyors, but also on the progress of modern improvement. He did not suppose that Mr. White meant to say anything derogatory to the practice of his profession, or to the high principle of modern architects in doing the best they could for their clients. But he protested, as a District Surveyor and an architect, that any gentleman should come there and talk of his brethren being guilty of direct infringement of an Act of Parliament. He had had a good deal of experience lately in connexion with the iron-door question, and he would join issue with Mr. White when that gentleman said that the fire-proof doors recently constructed had been inefficient. On the contrary, he would contend that the modern system of using fireproof doors had been a grand and great success, and this had been recognised by the insurance offices. The Stores in the Haymarket, with the greater part of their contents, had been absolutely saved by their fire-proof doors. The same remark applied to Messrs. Crosse & Blackwell's factory, and to the painting-room at the Alhambra, with its most inflammable contents. His experience differed entirely from that of Mr. White. Fire, as a rule, did not spread laterally, but ascended vertically. He had received many applications to allow the employment of concrete fireproof doors, but he did not consider them fitted for their purpose. Every engineer knew that in fitting furnace-work it was a mistake to use Portland cement, and all the best chimney-shafts and furnace-work were constructed with mortar, as heat made the concrete fly. He did not know that, on the whole, the sliding-door

was not the best. There had been a talk about shutting the door, but the necessity for this often did not arise until the fire occurred. In the case of the Haymarket fire the sliding-doors were closed after the fire originated, and yet they answered their purpose. If a door was made to open outwards it was a common custom to allow bulky materials to lie in the gangway, and it was generally in warehouses where these doors were, that they could not be closed in case of fire. The Act stated that stone lintels were necessary, and yet this was the worst substance that could be used. The late Mr. Whichcord, however, built the whole interior of the National Safe Deposit Company's building of fire-brick. It had been said that there should be only one door in a party-wall, but hitherto they had always considered that if a person wanted an opening on each floor he should have it, and there could be no objection to iron doors if made of proper material and constructed in a proper manner.

Mr. Tavenor Perry said that when folding doors were used, they frequently opened in the middle, leaving a considerable orifice, which was not the case with sliding-doors. At the Alhambra the sliding-doors effectually stopped the fire, although a quantity of scenery was stored against the other side of the doors.

Mr. J. H. Heathman believed the cause of the spread of the fire at Westbourne-grove was due not to the manner in which the doors were hung or closed, but through a door becoming heated. The heat radiated from that to the other door, and the timber took fire. He was of opinion that doors allowed to swing had full liberty to expand without warping, and if these were closely fitted, and hung in a proper manner, they would answer far better than a door which could not expand without burning. The Act of Parliament did not prohibit the placing of goods in close contact with the door. There should also be some limit to the distance at which timber was fitted near to a door. No timber either in the floor, on the walls, or at the top of the door, should be nearer than 18 in. to any ironwork composing the door.

A visitor, who did not give his name, but who said he had attended as a representative of the Fire Offices Committee, next spoke. As a matter of fact, he said, the Offices had lost faith in the Metropolitan Building Act as far as the doors went. They had suffered so much from the construction of the doors that they had endeavoured to help themselves in this matter. They had, therefore, found it useful in the case of some of the larger docks and warehouses to establish a door of their own, and they had special surveyors engaged to go about and insist that the doors should be built in a certain form. The Offices required that the door should be a hinged one of wrought iron, not less than ¼ in. thick in the panels, hung in a cast or wrought iron rebate, and firmly bolted to the wall; such door not to be more than 5 ft. wide and 7 ft. high, and to be in two leaves, not exceeding 2 ft. 6 in. each, fastened with bolts into the frame at the top and bottom. The intention was to prevent buckling when the pressure came upon the doors. The term double-iron doors was taken to mean a pair of iron doors similarly hung placed on each side of the opening in the wall so as to be distant from each other the full thickness of the wall.

Mr. Hansard believed that the Fire Offices were entirely wrong in insisting on folding-doors. The sliding-door, not too large in its dimensions, properly sunk into the floor, and with iron guides, was the best form. The top should be 1 ft. 6 in. or 1 ft. higher than the opening, and if such double doors were properly hung on sliding iron rails and wheels, he believed that no fire could possibly penetrate through the sides. According to present circumstances, a rebate was simply allowed to be sunk 2 in. in the wall. If it were unsecurely fastened, directly the fire played upon it it passed round the 2-in. rebate, and the danger was immediate.

Mr. H. H. Collins thought it was perfectly futile for any insurance office to lay down rules as to how these doors should be constructed, inasmuch as they had to be made according to the Act of Parliament, whether they liked it or not. He had applied on various occasions to the Board of Works for permission to vary the method of construction as defined in the Act, but it had met with an invariable refusal. Sliding doors, sliding shutters, doors sunk in the floors, and other matters, had invariably, and, he believed, rightly, been refused by the Board of Works, who had no power to vary that part of the Act. If District Surveyors had allowed this, they must have done so in contravention of the Act. After all, the regulations laid down by the Fire Committee seemed to be almost in accordance with what the Act indicated. Many of the doors, no doubt, were never touched from the time they were fixed, and the insurance company might insist upon this being done, or charging an increased premium where it was omitted. They, as officials, could only carry out the provisions of the Act, and the insurance offices should assist them in doing so, rather than lay down rules for the construction of doors. Match-boarding was a very fertile source of fire, and there was no reason why fire-resisting plaster should not be applied to walls. Iron doors were a source not only of anxiety, but were a great nuisance to District Surveyors, aad more particularly in the City of London. As Mr. White had said, if these questions were brought before the magistrates, they were simply ignored, or a decision was given totally adverse to what might be desired.

Professor Kerr agreed with the last speaker that it was for the fire offices to remedy whatever faults were complained of; the District Surveyors were absolutely powerless. Some people seemed to be unaware of the course that supplementary legislation would take. He happened to be present a good many years ago at a Committee of the House of Commons to consider the Bill brought in by the Metropolitan Board of Works for amending the Building Act. It was found, in dealing with it, that the Committee were going to throw overboard the restrictions with regard to the limitation of areas. Mr. Walter, of the *Times*, for instance, could not understand why the office of that paper should be divided by party-walls; and others, representing businesses on a large scale, were very much disposed to throw the buildings entirely open. As a District Surveyor, he found people extremely reluctant to have iron doors under any circumstances, and it became really a matter of persuasion. As to going to the Police Court, that was out of the question. It was true that the District Surveyor was more or less a policeman, but, if he took the offender before the magistrate, failure was the inevitable result, and he might have his feelings outraged and himself insulted. The magistrate was really sitting for the protection of the public against unnecessary official interference, and could not be got to understand the reason for the precautions in the Building Act. The fire offices should combine together, bearing in mind that this is a commercial and free country, and that dragooning will not be submitted to, except as a matter of contract. The offices had the power of contract with the public, and if they laid down ascertained rules, insisting on their performance, without doubt great good might be effected. Parliament had simply meant to advise the public what they ought to do, leaving the fire offices to bring their contracts to bear upon the matter.

The gentleman representing the Fire Offices Committee here referred to a case in which they had a warrant that the doors should be closed; but, when a fire happened in the night, it was discovered that the doors had been left open. Payment was resisted by the insurance companies, on this ground, but eventually they were advised not to plead that. Then, as to area, the limitation was often ignored, and he could point to a large building in Ludgate-hill, the dimensions of which were far in excess of the limits, and without provision for a division. They had felt bound to call the attention of the Board of Works to this matter, but were informed that the Act did not apply.

Mr. Wyatt Papworth thought it was important that the doors should be properly fixed. He had seen iron sliding doors where considerable space was left between the doors and the cement work.

A cordial vote of thanks was then passed to Mr. White for his paper.

Mr. White, in replying, remarked that, there being no means to compel the closing of the doors, he knew perfectly well the great difficulty that would exist supposing there was any compulsion. This seemed a main reason why the number of doors should be limited. If there was no limit, it could hardly be called consistent with what had been laid down in the Act of Parliament if it should be so strict in its limitations in a few details, leaving the rest wholly uncared for. It would be well to have sliding doors if they could be made to slide into closed fire-proof frames, but not where the door was on the face of the wall with nothing to protect it. Folding doors should not open more than to the square of the opening. He thought he had guarded against making any insinuations upon District Surveyors.

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We have received the following letter from Mr. Banister Fletcher:—

"It seems to me clear that Mr. White is entirely wrong in reading the Act, because if we refer to Section XX., Sub-section XIV., we see 'no flue shall be,' &c. Clearly, therefore, no opening is to be limited to one opening, only one flue is to be built against a party structure,—which I think even Mr. White will agree, the Act never contemplated.

I might also cite Sub-section XV., but it appears to me, as it does to all those to whom I have spoken, that the meaning of the Act is clear, namely that there may be more than one opening, but that no opening shall be made except subject to certain restrictions.

We District Surveyors must interpret the Act in its legal manner, for, as Mr. Jennings pointed out, all our decisions are subject to the review of the court.

With regard to the statement made by the gentleman from the Insurance Offices as to the requirements by the Fire Offices, I venture to point out the defects.

It is well known that many fireproof-doors have been shut after a fire has commenced, as was mentioned in the discussion by Mr. R. Walker; and if they are swing-doors they may have become so heated and have consequently so expanded that they cannot be shut. Another drawback is that all such doors must have spaces at the top, at the bottom, and at the sides, through which the air can pass, and, of course, fire; whilst sliding-doors, which can be and are made several inches wider and higher than the opening, prevent more effectually the fire circulating; and at the bottom, as the door may and should go into a groove (as mentioned by Mr. Octavius Hansard), the draught cannot get under the door with nearly the same ease as it can with the swing door. The further objection to the swing door that it is much in the way seems to me to be important.

To show that the Insurance Office officials alter their requirements, I would mention that when I was superintending the building of the Monument Wharf and Bonded Warehouse, in Thames-street, acting as Surveyor to the Dyers' Company, much loss of space was occasioned by the Fire Office insisting that 3 ft. space should be left between the iron doors. I write this to show that the Fire Offices have varied their requirements, which would seem to show that they are not certain as to the best method, although the gentleman seemed to speak with such confidence that they thoroughly understood the subject.

I may mention that the District Surveyors' Association has lately been giving special attention to the subject of fires and fire-proof construction. One of the great causes of the spread of fires is the lift, as to which little was said last night.

I feel sure the result of the discussion will be to show that Mr. White has misread the Act, and to fully acquaint both District Surveyors and architects of the serious charge that they *act in defiance of legislative enactment*."

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**The Lambeth Water Company's Extension Works.**—For several months past the Lambeth Water Works Company have been engaged in laying down a new and enlarged line of water pipes between their intake at Kingston and their reservoirs at Brixton. This has been found necessary in consequence of the great increase of supply by the company during the last few years, and the inadequacy of the existing pipes to convey the water required. Between the company's works at Kingston and the reservoirs at Brixton the distance is upwards of eleven miles, and from Kingston the pipes are being laid along the main high road, passing through the parishes of Norbiton, Wimbledon, Merton, Tooting, Balham, Clapham, to the works at Brixton. The work has now been carried forward as far as Balham. The pipes, which are 3 ft. in diameter, are being laid down by Mr. Docwra as the contractor. The undertaking includes the construction of additional storage reservoirs at Brixton.

## ARCHITECTURAL ASSOCIATION.

THE seventh ordinary meeting of the session took place on Friday, the 16th inst., Mr. Cole A. Adams, President, in the chair.

The following new members were elected:—Messrs. E. C. Macpherson, G. W. Tait, C. H. Mason, R. W. H. Edis, G. E. Pilkington, and S. T. Wenborn.

It was intimated that the first visit of the members would take place on Saturday next, the 24th inst., to St. Marylebone Parish Church, Mr. Harris, architect.

The Chairman referred to the loss sustained by the profession in the death of Mr. John Whichcord.* Those who knew that gentleman knew him as a man of rare attainments and of the strictest integrity, and one who, in his own particular line, was second to none. In his younger days Mr. Whichcord, he believed, had devoted himself to the study of architecture and colour decoration, but latterly his practice had led him more into that of a surveyor, entrusted with some of the largest concerns and arbitrations in the City of London and neighbourhood. Mr. Whichcord had the rare distinction of having his name frequently put into contracts as a reference, and the mere fact of a man having won character for integrity and for the strictest judicial mind was worthy of notice. Mr. Whichcord was buried at Kensal Green on the preceding day, and he (the Chairman) had the melancholy duty of representing the Association at the funeral.

The Chairman also drew the attention of the members to the Architectural Association Sketch Book, the plates of which were displayed on the walls. Many of the sketches were of a very high character, being excellently drawn, and evincing much artistic feeling. He hoped the subscription list would be enlarged.

The Chairman, in introducing the lecturer of the evening (Mr. Farrow), said that that gentleman, like Mr. Gale and Mr. McLachlan (both members of the Association), had distinguished himself by winning the Godwin Bursary.

Mr. F. R. Farrow then read a paper on "The Ventilation of Public Buildings." The substance of this we give on preceding pages.

The Chairman, in opening the discussion, rejoiced that Mr. Farrow, one of their most talented members, had taken up the question of the science of ventilation, and gone so thoroughly into it. The more his example was imitated the better it would it be for the profession. Mr. Farrow had not called attention to one very important medium for ventilation, viz., the warm-air stove. One of the best stoves was that designed by Mr. D. O. Boyd, the curator of the Museum of Building Appliances. By means of this a large volume of fresh air was brought into the room, and the fire, instead of drawing the air needed to support combustion from leaky doors and draughty windows, kept the room at a comfortable temperature. In his practice he had found the Tobin tubes useful. In some positions there would be a down-draught from them, but with a little care that could be obviated. Mr. Farrow had referred to a down-draught in connexion with the syphon ventilator; but this could be prevented by having a board suspended underneath the down-cast to distribute the air. Then there was the simple plan of the ordinary sash window, with the bottom bead of the lower sash made of sufficient height to allow of the admission of air at the meeting-rails, without draught.

Mr. J. A. Gotch, in proposing a vote of thanks to Mr. Farrow, expressed his satisfaction that the paper had not been loaded with statistics.

Mr. H. G. Turner explained the system of ventilation used in the Houses of Parliament, which was believed to be the best ventilated building in the world, though the cost was very great. He differed from Mr. Farrow as to the best method of extraction. In his opinion heat was the best method, as it could be regulated to a nicety, it being possible in the Houses of Parliament to regulate the temperature to half a degree. One of the best ventilated of the smaller buildings of the metropolis was the Brompton Hospital for Consumption. There the fresh air was brought in at the ground level and warmed by passing over coils. The foul air was extracted in vertical tubes with outlets into these at the floor and ceiling levels. The out-patients' department of a hospital was often most offensive, but in the case of the Brompton Hospital it was perfectly sweet and pleasant. The general public rather than the architects were to blame for the want of ventilation. To do it well cost money, and the public would not pay for it, while, if it were done, and anything went wrong afterwards, the unlucky architect got the blame. Mr. Turner concluded by seconding the vote of thanks.

Mr. H. W. Pratt remarked that architects frequently erred in not allowing sufficient cubical contents to public buildings, churches, and chapels. The Tobin principle had been designed to improve the ventilation of such buildings, and if the area of the tubes and their position were more studied, they would be found more successful as a simple means of introducing air. Air might be warmed without extra expense by the ordinary heating apparatus used in the buildings. Boyle's system had been designed for the extraction of the vitiated air, but architects made a mistake in enclosing the cowls in turrets.

Mr. Stokes did not believe in the great necessity for extraction so long as sufficient air was introduced, for then the foul air must go away. If there was a ventilating grate they must trust to Providence for the removal of the foul air. The down-draught from the Tobins often arose through the tubes being too large, and it was better to have a great many small tubes than too few large ones.

After a few remarks from Mr. Ellison, Mr. Mountford, and Mr. Blagrove, the vote of thanks was passed by acclamation.

Mr. Farrow, in replying, said that he had purposely avoided, as far as possible, any reference to the heating of buildings, because it would have occupied the whole of the time at his disposal to have explained the different methods. He had simply dealt with the ventilation question, and the requisite amount of heat which would have to be provided in some way. The Houses of Parliament were good examples of effective ventilation, but there was no doubt the system was an extremely costly one. Most authorities were of opinion that for any given expenditure a better result would be obtained by the use of rotary fans, together with engines, &c., than by the use of enormous furnaces, and a great consumption of fuel.

* For memoir, see last week's *Builder*, p. 98.

## SANITARY AID COMMITTEES.

FROM the *Charity Organisation Review*, a monthly pamphlet issued by the Charity Organisation Society, in lieu of their former weekly *Reporter*, we quote the following information in regard to the working of volunteer sanitary aid committees, given by Miss Gertrude Toynbee, a worker on the Marylebone Committee:—

"Thirty-three of these committees have been formed in London, and about twenty of them are vigorously at work. The results accomplished by the latter are quite sufficient to justify more widespread action, and it is to be hoped that when their first annual report is circulated the less vigorous committees will take heart and set to work. The facts which suggested the movement remain as a justification for its continuance. Illegal insanitary conditions in the homes of the working people are more or less universal; the tenants are not sufficiently independent to be able to protest for themselves; the sanitary officials are too few, and their standard too low, to find out any very great number of nuisances on their own account.

It will be as well to give some detailed experiences of sanitary aid work in one district, *e.g.*, Marylebone. There we have three committees at work, the parish being divided for our purpose into North, East, and West Marylebone. These committees have now between them had about 400 cases, and they have proved to be, with very few exceptions, *bonâ fide* cases, trivial complaints being rare. Speaking roughly, from sixty to seventy remain on hand, the rest having been dismissed as satisfactorily dealt with. But it must here be noted that the endless amount of time and labour expended by the committees to achieve these results would be almost incredible to outsiders. There are many cases which have been visited and reported on, fortnight after fortnight, for months and months, often for six months, and not infrequently for longer. What happens is this. The sanitary inspectors not only delay their visits of inspection, but delay giving orders to the landlords, and when the orders are given, delay taking measures to enforce them. Hence the landlords simply play with them. In most cases some trifle will be done at first, and promises of more will be made, but there the matter rests for months, until, by persistent complaints from the Sanitary Aid Committee, the whole nuisance is at last abated.

1. There is no doubt that more inspectors ought to be appointed. Their salaries would not materially increase the expenditure of the Vestry, while the improved sanitation thus obtainable would lessen the amount of ill health among the poor, and so compensate the rate-payers.

2. The present staff of inspectors ought to have their work more thoroughly supervised. At present, owing to apathy and want of system, they get through much less work than they might, and much that they do take in hand is ineffectual. Doubtless what we want is a large body of zealous, disinterested gentlemen on the Vestry, who shall make themselves somewhat responsible for the sanitary condition of their district by becoming personally acquainted with it, and with the work done by the inspectors. Such men would do much to raise the official standard of sanitary reform in their district.

Considering the difficulty the Sanitary Committees have had in getting sanitary laws enforced, it is not surprising that the tenants find that when they do muster up courage and energy to make a complaint to the vestry they cannot get it attended to. The other day one of the usual complaints of bad drainage, &c., came before the West Marylebone committee. The tenant had lived twenty years in the house, and had himself complained again and again to the vestry and to the landlord, but he could get nothing done. He had constant ill-health in his family, and the doctor asked repeatedly whether the drains were wrong. When the Sanitary Committee complained to the vestry the drains were taken up and found to be broken and porous; neither the water-closet nor the sink had traps, while the only cistern was uncovered, in an outhouse, from the roof of which blacks and cobwebs fell into the water. A new pipe drain and traps were provided, and the committee hope to secure also a proper cistern. This tenant pays a heavy rent, and pays it regularly; and this is the case with a great number of the tenants with whom the committee have had to deal, so that they feel that in pressing the claims of such people to a sanitary condition in their homes they are but doing a simple act of justice.

The tenants, as a rule, have been most grateful for the interference of our committees, and this in spite of their having received a good deal of rough abuse, not only from the landlords, but, I am sorry to say, from the inspectors as well."

## "A CLUB-ROOM AT THE INSTITUTE"!

SIR,—I have not misunderstood Professor Kerr, but that gentleman has misunderstood himself.

There can be no cohesion between summer and winter.

What is the use of saying, "Those who are in favour of such a measure might," &c. (*Builder*, p. 118, *ante*), when many more than half of the members of the Institute have no vote, and whose opinions count for nothing upon a division?

It is childish to talk of "a member having anything on his mind" following any such suggestion as submitted.

If it is desirable to "compare notes," let senior members give lectures of their experiences.

There has been a late proof of a very strong cohesion among the younger members, but the attachment of this to the senior members does not surely depend upon the unsavoury atmosphere of a coffee-room.

I am jealous of the dignity and character of our premises at No. 9, Conduit-street, being preserved; and if Professor Kerr has no better legacy to leave to the Institute, he must know, at any rate, that to this "restaurant" idea must be answered

No!

*** We also say "No." The notion seems to us unnecessary, and quite incompatible with the resources of the architects' house in Conduit-street.

**Whiston.**—A large memorial tablet has just been erected in Whiston Church, Northants, to the memory of the late Lord Boston, by his uncle, the Hon. and Rev. L. Irby, the rector of the parish. It has been executed in alabaster and Turkish marble by Messrs. Farmer & Brindley, from the designs of Messrs. Taylor & Gordon, architects.

## ASBESTOS PAINT.

SIR,—Referring to the preservation from fire of inflammable building materials, in his presidential address at the Institution of Civil Engineers on the 13th inst., Sir F. Bramwell said :—

"The processes, more or less successful, that have been tried are so numerous, that I cannot even pretend to enumerate them. I will, however, just mention one, the asbestos paint, because it is used to coat the wooden structures of the Inventions Exhibition. To the employment of this, I think it is not too much to say, those buildings owed their escape, in last year's very dry summer, from being consumed by a fire that broke out in an exhibitor's stand, but happily not setting the painted woodwork on fire, although it was charred below the surface. I do not pretend to say that a surface application can enable wood to resist the effects of a continued exposure to fire, but it does appear that it can prevent its ready ignition."

It may prevent misconception if you will allow me to add that there are two kinds of asbestos paint, both equally valuable in their way, viz. :—

1. Asbestos paint *ground in oil*, and mainly used for ironwork. This is not *fireproof*, but resists to a remarkable extent the action of gases, foul atmospheres, &c., preventing corrosion.

2. *Asbestos patent fireproof paint, exclusively* for timber-work. In the latter, no oil or other inflammable material is used, and this is, of course, the paint referred to by Sir F. Bramwell, and which we have supplied for the wooden buildings of the three Great Exhibitions at South Kensington.

J. ALFRED FISHER,
General Manager and Secretary.
*United Asbestos Co.*

## THE ROYAL ARMS.

SIR,—In your well-written sketch of these, which supplies the out-of-the-way knowledge not easily got at by the world, you omit (or, may I say, perhaps did not know) the curious fact that in Scotland the supporters, the lion and the unicorn, hold reverse positions to what they hold throughout the rest of the United Kingdom; and this was actually stipulated for in, and, I believe, is one of the clauses in, the Act of Union (*circa* 1700-1710, I think) between England and Scotland.

You can see them on the Edinburgh Post Office and Stamp Office, and I think I state a fact that when these two buildings were erected, when the then new Regent Bridge was opened, about 1818 or 1819, the stipulation was not attended to, and the local authorities insisted on its being carried out, which had to be done. I lived in Edinburgh then and can almost remember the circumstance.

EDWARD COCKBURN.

## PROVINCIAL NEWS.

*Loughborough.*—Owing to the increase of nearly 25 per cent. in the population of Loughborough, the water supply has been gradually becoming insufficient, and during the drought of the past summer the store of water in the reservoir was wholly exhausted. So far back as 1878 it was pointed out to the Local Board that the capacity of the existing works had been reached, and that a prolonged summer drought might at any time jeopardise the supply to the town, and in 1880 Mr. George Hodson, C.E., F.S.I., of the firm of Hodson, Price, & Hodson, the then surveyor and waterworks manager, was authorised to devise a scheme of extension, and advised a resort to the Black Brook, a stream on Charnwood Forest, which, at a point about five miles from the existing works, where its watershed was about 2,800 acres, might be intercepted and brought by gravitation into the present reservoir. The minimum dry-weather yield of this stream is 500,000 gallons per day, and the average available supply will be from 800,000 to 1,000,000 gallons per day. Owing to various circumstances the Board at that time declined to commit themselves to the expense, and consulted Mr. Eaton, of Sheffield, who recommended the construction of a large impounding reservoir on the Wood Brook, and subsequently also consulted Mr. Robinson, C.E., of London, upon the Wood Brook scheme. The experience of last year has, however, satisfied the Board that no sufficient supply can be obtained from the source recommended by Mr. Eaton. They have, therefore, resolved to adopt Mr. Hodson's scheme, and have served notices upon the owners of the water rights of their intention to promote a Bill in Parliament for the execution of the works. As Mr. Hodson is a member of the Board his firm cannot carry out the works, and the Board propose appointing an engineer to undertake their execution. Since this was written we learn that the Local Board have instructed Mr. Herbert Walker, C.E., F.S.I., of Nottingham, to prepare the requisite Parliamentary plans and estimate for the scheme.

*Henley-on-Thames.*—A drinking-fountain of some importance is about to be erected in the Market-place, as a memorial to the late rector, the Rev. Greville Phillimore. It will be built on the site now occupied by an awkward-looking obelisk and an equally uncouth pump which adjoins it, both of which will be removed. Mr. James Forsyth, of Finchley-road, is the sculptor.

*Wigan.*—A large drill-hall was recently opened in Powell-street, Wigan, by the Earl of Crauford and Balcarres, Lieut.-Col. 4th L.R.V. His lordship, in his address, congratulated the Wigan Volunteers on now possessing one of the finest drill-halls in the country. The cost has been 3,300*l*. Messrs. Isitt & Verity, of Bradford and Wigan, were the architects.

*High Wycombe.*—The useful Cottage Hospital of this town has been recently enlarged from affording twelve to sixteen beds, a new ward having been constructed, called the "Augusta" ward, from the gift of 100*l*. presented by her family in memory of the late Lady Carrington towards the cost. The builder was Mr. J. I. Harris, and the architect was Mr. Arthur Vernon, both of High Wycombe.

## SCHOOL-BUILDING NEWS.

*Witney.*—The Wesleyans of Witney have just completed the erection of new and commodious schools, which were opened on the 5th inst. The building is in Late Gothic style, the walls being of stone and the roof of blue slate. The ventilating is by means of air-trunks laid along the whole length of the ceiling, with Boyle's air-pump ventilators. The building is heated with Bacon's high-pressure hot-water apparatus. The architect was Mr. E. Early Hollis, of London, and the builders were Messrs. Bartlett Brothers, of Witney.

*High Wycombe.*—New schoolrooms have been erected, and were, on the 11th instant, formally opened, in connexion with the Union Chapel, High Wycombe. The buildings comprise schoolroom, 50 ft. by 24 ft., with lavatories, outbuildings, &c.; and the construction, out of the old school buildings, of six class-rooms, large organ, and choir chamber, at the rear of the pulpit platform; the galleries and part of the building have been re-pewed, and the whole decorated, the total expense being about 1,200*l*. The contractor was Mr. G. H. Gibson, High Wycombe, who executed the work under the direction of Mr. Arthur Vernon, architect, of the same place.

*Wycombe Marsh* (*Bucks*).—New national schools in connexion with St. Anne's Church have just been completed and opened. They comprise a large room and class-room, and are constructed in the Early Gothic style in red bricks and dark tiles. The outlay (for 100 scholars) has been 350*l*. Mr. W. R. Loosley, of High Wycombe, was the contractor, and Mr. Arthur Vernon, of the same place, the architect.

*Wooburn Green* (*Bucks*).—Considerable additions have just been completed to the National Schools, Wooburn, by the construction of a large class-room of brick, flint, and slate, and an ornamental Early English drinking-fountain for the accommodation both of the children and of passers-by. The builder was Mr. C. H. Hunt, and the architect, Mr. Arthur Vernon, High Wycombe.

## STAINED GLASS.

*Burgess Hill.*—A five-light Munich east window has just been placed in the church at Burgess Hill, illustrating the text "Come unto me all ye that labour and are heavy laden," in memory of Thomas Crunden, of Burgess Hill. The work has been designed and carried out by Messrs. Mayer & Co.

*Leamington.*—There have been fixed in the nave of St. John's Church three more stained glass windows containing figures of St. Alban, St. Patrick, and St. Dubritius, who was the first and only bishop of Warwick. It is intended to continue the series of English saints in the other windows round the church. Those already placed have been executed by Messrs. F. Holt & Co., of Warwick.

*Hampreston.*—The fifth and remaining window in the chancel of Hampreston Church has just been filled in with stained glass representing the "Good Shepherd." The artists are Messrs. Mayer & Co., who also carried out the former windows.

# The Student's Column.

## LIME, CEMENT, AND THEIR USES.—IV.

THE strength of a cement mortar as compared with a lime mortar has not as yet been very clearly defined; in fact, it is hardly possible to compare the two. Portland cement is so much stronger than lime that the best lime mortar is not equal in strength to a mortar made of one part good Portland cement and ten parts of sand. As a mortar of this consistency could hardly be used in practice, it being what is termed "too short," *i.e.*, not sufficiently plastic, it is clear that a cement mortar must always have a greater strength than one made of lime. A cement mortar is, therefore, only used where great structural strength is required, or where it is required to set quickly.

A very good mortar is produced by a mixture of five or six parts of sand to one of cement, and is one that has sufficient plasticity to be worked easily. The proportion of the cement and sand is always taken by measure, and it should be seen that the sand is dry, because more sand will go into a given measure when it is wet, and it would, therefore, be necessary to use more cement to obtain the same proportion if the sand is measured in this condition. The dry measured sand should be placed on a clean platform, and the measured cement placed on the sand; the two should then be thoroughly mixed, without the addition of any water, by turning them over and over with shovels. From this heap of cement and sand so much only as can be used at once should be taken, and the water added to it gradually, working it at the same time with the trowel or spade until it is reduced to the proper consistency for use. The use of too much water should be avoided, because it reduces the strength of the mortar, and the desired plasticity should be obtained by well working it. As soon as it is properly gauged it should be used at once, and not allowed to partially set on the board and be beaten up again, for this only destroys the cement and renders it of no value whatever. Cement, when it has once commenced to set, cannot advantageously be further worked. Too much importance, therefore, cannot be attached to this detail. In making cement concrete, the same general principle must be carried out. The measured aggregate being put first on the mixing platform and the cement placed on the top of it. It is usual to have four men with shovels to mix this, and the operation is to turn over the whole of the material on to another part of the platform, and then back again to its original position, and it should be turned over at least three times dry. The water is then added from a rose. A jet of water is objectionable because it tends to wash the cement away from the aggregate, and nullifies, to a certain extent, the previous operation of dry mixing. The water should, of course, be directed to the portion of the heap which is being turned over, and the concrete should be turned over at least twice wet. By thus turning it over three times dry and twice wet, a nearly perfect mixture of the aggregate and matrix ought to be obtained, and the concrete is then ready to be removed in barrows or skips to its position on the work. The caution regarding the use of an excess of water must again be given, for the additional reason, beyond that already stated, that too much water will wash away a considerable quantity of the cement.

It is desirable to have the mixing platform as near the position in the works where the concrete is to be laid as possible, not only that the labour of wheeling may be reduced to a minimum, but also that the whole operation of making the concrete and laying it in position may be executed as expeditiously as possible; for it is most important for the production of a good cement mortar or concrete that it should be laid in position and left at rest in as short a time as possible after the water has been added to it, and that it should not be afterwards disturbed. The concrete should be laid gently in position, and then shovelled and beaten level. The practice of tipping it in from a height, except in exceptional cases, is to be avoided, as it tends to separate the larger and smaller aggregate and the matrix.

The manner of using lime is somewhat different, because, unlike cement, it is not sold in a condition fit for use, *i.e.*, it is in a condition of pure or quick lime, which, on the addition of water, heats and swells to a greater

or less extent, according to whether it is a rich or an hydraulic lime. A rich lime expands on the addition of water to twice its bulk, and sometimes more, and then quickly falls to powder, while an hydraulic lime expands but little on the addition of water, and is some time,—it may be days,—before it falls to powder. Adding water to quick lime is called slacking it, and by this process it is converted into a hydrate of lime. In this condition it is fit for use, and theoretically the best results are obtained by using a lime immediately that all parts of it are perfectly hydrated, and before the hydrate has absorbed any carbonic acid from the atmosphere.

Lime should be slacked by breaking it into even-sized pieces, and spreading it out in a thin layer, and then sprinkling it with water from a rose. By this means it is ensured that all portions of it have been wetted. It should then be shovelled up into a heap and covered with sand, so that it may retain the heat produced by the hydration. When it has fallen to powder, it should be sifted in order to remove any portion of it which has not slacked, and is still in lumps. It is then in a condition to be made into mortar by mixing it with the desired quantity of sand, and gauging it with water to the desired consistency by working it with shovels or trowels. A better mortar is made by grinding it in a mortar-mill, but on small works mortar-mills are not always available. In slacking lime care should be taken only to add so much water as is sufficient to wet the whole of it. If too much water is used, the lime slacks into a pasty mass, instead of falling into powder. At the first sign of any water running away from the lime and accumulating on the floor is observed, no more water should be added, for it is an indication that the lime has absorbed all it can, and it should then be at once shovelled into a heap as described above. Lime may be made into what is called putty by adding water to it when it has fallen into powder, and making it into a thick slip; in this condition it is run into a trench in the ground, where it may remain for several weeks until required for use. In this form it is generally used for internal work; but it may be made into mortar with the addition of sand. It will, however, not produce so strong a mortar as when made in the usual way. Lump lime is generally used for mortar, and ground lime for concrete. It is only the poor and hydraulic limes that are ground, as rich limes disintegrate so easily on hydration that there would be no object in grinding them. Ground hydraulic lime may be used for concrete without previous slacking.

Unlike cement, lime mortar may be worked up again without serious detriment to its strength by the addition of more water, and a lime concrete cannot be rammed and beaten too much.

With these few differences, the points requiring care are the same whether using lime or cement, and the same precautions and manners of manipulation are common to both.

The quantity of sand which any particular lime requires to enable it to give the best results can only be determined by experiment; and the only guide for the determination of the amount of sand to use is by the plasticity of the compound. When too much sand is added the mortar works "short," and in that condition it is not economical to use,—from two to four parts of sand to one of lime is the proportion usually adopted. The proportion of sand to lime is always measured by so many striked measures of dry sand to one fair measure of lump unslacked lime.

A few words of caution are, perhaps, necessary respecting the bricks and other materials which are to be united by the mortar. It is assumed that the mortar, whether it be of lime or cement, has been made of good materials and with proper care. Now, if in this perfect condition it is laid on to dry bricks or stones the whole of the water in it is immediately absorbed by the hot porous surface; the lime or cement is thus deprived of the water necessary to ensure a perfect set, and the mortar is reduced to a friable consistency of no adhesion or strength. It is, therefore, most important that all surfaces, more especially in hot dry weather, should be well wetted or even soaked in water before the mortar is put on to them. In stucco work all brick joints should be raked out to a good depth and the surface of the bricks well cleaned before the stucco is laid on. In the same way when using old materials all old mortar should be removed from the bricks before they are re-used, for new mortar will not adhere well to such friable and imperfect surfaces, added to which the strength of the structure would, in the event of the old mortar being left on the bricks, be reduced to the strength of the old mortar instead of, as it should be, the new.

In concluding these remarks the necessity of care in the choice of materials and in their manipulation cannot be too strongly enforced. The strength of the structure depends on the strength with which its parts are held together, and it is the mortar which has to exert this strength. Smeeton, when building the Eddystone Lighthouse, spent more time and trouble in the selection of the materials for his mortar than in selecting the stone, and with the satisfactory result that his work stood a strain which is seldom put on any building. While Smeeton was working here Vicat and others were working in France, and to these two must be given the honour of laying the foundation of all now known respecting the behaviour and proper treatment of limes, cements, and mortars. The works of Vitruvius show the importance attached to the strength of limes and mortars two thousand years ago. In this century General Pasley spent half his life in making experiments having a similar object, the results of which are of the greatest value. When men like these thought it wise to make research into the nature of the materials they were using, it is surely worth the while of those who may have to use mortar every day of their life to make themselves, at all events, slightly acquainted with the materials of which it should be compounded and the best manner of its manufacture, and disabuse themselves of the opinion that road scrapings and other similar dirty materials make adequate mortars.

## RECENT PATENTS.

### ABSTRACTS OF SPECIFICATIONS.

11, Fire-resisting Compound. W. Graham.

A refractory composition is used, either alone or mixed with other fire-resisting materials. With this the backs of stoves, furnaces, ladles, &c., are lined. The ingredients are four parts silica, one of silicated carbonised clay, and one and two-thirds clay, which proportions may be varied according to requirements.

1,690, Sash-bars or Astragals. J. D. Mackenzie.

A development of a former invention. According to this method of glazing, the metal astragals are of a semicircular form, and are enclosed in a thin strip of some non-oxidisable metal. A strip of lead or other metal is bent over the top of the astragal, to which it is secured by screws or bolts, to keep the sheets of glass in place. A strip of vulcanite, papier mâché, or similar material, being sometimes interposed.

2,653, Chimney Tops. C. Riley.

These are formed with openings in the sides near the base. Flanges or ribs inclined upwards, and provided with slits to facilitate sweeping, are connected with these openings, and project within the chimney-shaft: thus currents of air are deflected upwards, and draw out any smoke or foul air with them.

4,098, Ornamental Moulds and Frames. S. Albû.

Strips of velvet or plush are glued upon the bending of mouldings or picture-frames, rods being laid upon the strips until the glue has set. The juxtaposition of the velvet or plush with the gold mouldings of the frames gives a rich effect.

5,014, Venetian Blinds. J. Querre.

The laths are counterbalanced by weights. Two chains are fastened to the bottom lath, passing upward through slots in the laths turning over pulleys, and fixed to weights at the side. It is so arranged that some little force is required to pull the blind down, where it is kept in position by cords fastening at the sides of the frame.

13,841, Closet and Dust-bin combined. J. Ennals.

This structure resembles the ordinary privy without a cesspool. It is all above the ground-line, preventing any soakage, which is often the seat of much soil. The floor is raised one step. The bottom of the receptacle is 3 in. of concrete coated with cement, with a slight incline towards the front to encourage the moisture to draw where the dust falls, thus the urine is absorbed and the excreta deodorised. The seat forms a lid for the dust-bin, being hung with butt hinges, and is firm as a fixed seat when closed. At the back is a door or flap hung on hinges to admit of its being easily emptied, as the contents (it is claimed) being quite innocuous can be taken out with a shovel and removed in a basket or barrow. Over the door are louvre-boards, which, with a small opening above the plate at back between the rafters, will cause a free circulation of air overhead, and always keep the place perfectly sweet.

4,614, Improved Devices for Opening and Closing Window-sashes and Fan-lights. Tosh & Preston.

The improvements comprise a long screwed spindle, which is pivoted to the fixed framing of the window, near the opening edge of the movable sash, and a grooved pulley fitted to turn thereon as a nut. A cord is passed over the pulley by which it is turned on the screwed rod or spindle. The pulley in turning travels along the edge of the screw spindle, drawing with it the edge of the window-frame to which it is secured, thus opening the window or fan-light to any extent desired.

### APPLICATIONS FOR LETTERS PATENT.

*Jan.* 9.—314, J. Lee, Improvements in the Intermediate or Junction Parts of Trowels, Spades, &c.—324, W. Stobbs, Construction of Kitchen-ranges and Cooking-stoves.—325, W. Beck, Instrument for Setting-out Curves.—331, M. Ismay, Latch or Device for retaining Doors in their Closed Position.—333, W. Heelis, Combination Cupboard, Wardrobe, or Bookcase.

*Jan.* 10.—339, J. Lorrain, Heating, Cooling, and Ventilating.—340, R. Roseborough, Manufacture of Faced or Coated Bricks, and Apparatus for same.—363, A. Reddie, Improvements in Bakers' Ovens.—373, H. Lake, Improvements in Excavators.—375, A. M. Clark, Improved Process of Manufacturing Tools of Steel.

*Jan.* 12.—382, J. Snowdon and S. Swallow, Panelling and Pressing Bricks.—384, F. Silk, Fastening Windows and Casements.—387, J. Lucas and C. Hall, Combination Pliers.—389, D. Dickinson, Device for Preventing the Over-sliding of Drawers, Shelves, Sliding-doors, &c.—390, F. Kellow, Improvements in Bricks.—400, A. Andrews, Mouthpieces and Dies used in the Manufacture of Clay Bricks, Earthen Pipes, &c.—406, M. Macleod, Laying Asphalte Pavements, Roofs, &c.—425, W. Wegner, Improved Staircase.

*Jan.* 13.—472, J. Imray, Air-Gas Apparatus.—486, J. Hancock, Producing Ornamental and other Devices in or between Sheets of Glass.

*Jan.* 14.—505, M. Syer, Syphon Water-waste Preventers.—515, D. Barclay, Removing and Replacing Earth-closets.—520, F. Botting, Smoke Test for Drains, &c.—535, R. Henry, Window-sash Line-holder.

*Jan.* 15.—579, S. Graham, Combination Ladder, Folding-steps, or Trestle.—580, T. Brindley, Improved Barrel Lock.—582, H. Hughes, Telescopic Lattice Window Guard.—598, H. Newton, Tools and Tool-holders for Planing Machines.—609, E. Tomlinson, Ventilation.

### PROVISIONAL SPECIFICATIONS ACCEPTED.

15,009, J. Hopkinson and R. Lapage, Improvements in Roller Blinds.—15,525, W. R. Lake, Water-closet Apparatus.—15,745, E. Reese, Decoration of Chimney-pieces, &c.—15,749, H. Whitaker, Fitting Wash Stands and Lavatories.—15,751, J. Howie, Improvements in Drain Traps.—15,755, T. Durrans, Gully Traps.—15,857, H. Gardner, Surfacing Compound for Coating Buildings, &c.—15,871, W. Withington, Improvements in Water-closets.—16,111, J. Edwards, Unpickable Lock.—16,163, J. Dinsmore, Band-saw Machines.—16,431, A. Myall, Grates and Stoves.—16,432, F. Knott, Apparatus for Drawing Ellipses.—16,523, R. Holmes, Fire Grates.—16,740, J. Bloomfield, Method and Material for Jointing Earthenware Pipes.—16,889, H. Britten, Machine or Apparatus for Painting Walls or other Surfaces.—15,846 H. Besson and E. Kent, Locks or Fastenings.—15,963, W. R. Lake, Refractory Compound for the Manufacture of Bricks, &c.—16,225, J. Loftus and S. Baker, Locks for Fastening Hinged Lids and other Hinged Parts.—16,458, J. Dann, Construction of Step Ladders.—16,582, F. Stolze and E. Morgenroth, Apparatus for Cooking and Heating.—16,657, H. Bridge, Apparatus for Facilitating the Sharpening of Plane Irons, Chisels, &c.—16,821, J. Herbert and T. Colley, Sash-bar Cramp.—16,851, A. Emley, Cooking Ranges.

### COMPLETE SPECIFICATIONS ACCEPTED.

*Open to opposition for two months.*

2,368, H. Hargreaves, W. Beckett, and W. Cliff, Kilns and Ovens for Burning Bricks, Pipes, &c.—2,871, J. Duckett, Signal-indicating Letter Box and Door Bell.—4,031, T. Waller, Constructing and Ventilating Urinals.—4,561, A. Martin, Machines for Embossing Wood and other Surfaces.—4,569, S. Slater, Weather Strips for Doors and Windows.—5,327, J. Sibbald and W. Kinnes, Regulating the Supply of Water to Closets and Cisterns.—8,125, J. Smeaton, Heating, Cooling, and Ventilating Dwelling-houses and other Buildings.—13,391, J. Waller and B. Farringdon, Bell Levers and Bell Pulls.—16,066, C. Clarke and A. Parsons, Sash-fasteners.—16,251, E. Brady, Substitute for Wood, Stone, or Iron.—4,286, F. Candy, Lavatories and Closets.—4,607, S. Guinery, Sash-frame Pulley.—4,856, W. Cornell, Ornamenting Bricks, Blocks, &c.—6,019, J. Kerr, Construction of Pavements.—7,399, S. Belham and J. Belham, Chimney Pot or Terminal.—16,530, W. Gwynn, Folding Steps.

## RECENT SALES OF PROPERTY.

ESTATE EXCHANGE REPORT.

JANUARY 15.

By NEWBON & HARDING.

| | |
|---|---|
| Enfield Highway—The Rose and Crown public-house, with six cottages and a plot of land, freehold | £2,500 |
| St. George's-in-East—23, Cannon-street-road, freehold | 450 |
| Dalston—19, Abersham-road, 17 years, ground-rent 6*l.* 10*s.* | 335 |

By PETO, YETTS, & Co.

| | |
|---|---|
| The Reversion to One-fourth Share of 1,078*l.* 3*s.* 6*d.* Bank Annuities, Life aged 84 years | 170 |
| The Reversion to 45, Victoria-road, Kensington, term 37 years, Life aged 80 years | 800 |

JANUARY 16.

By FRANK LEWIS & Co.

| | |
|---|---|
| Holloway—18, Hornsey-street, 73 years, ground-rent 7*l.* | 330 |

By BAKER & SONS.

| | |
|---|---|
| Battle, Sussex—The Residence called "The Woodland," and 254*a.* 3*r.* 37*p.*, freehold | 15,500 |
| Sudbury—A plot of freehold land | 105 |
| Ryde—9 to 12, High Park-terrace, 2,000 years, ground-rent 34*l.* | 10 |

## MEETINGS.

SATURDAY, JAN. 24.

*Architectural Association.*—Visit to St. Marylebone Parish Church. 3 p.m.

MONDAY, JAN. 26.

*Surveyors' Institution.*—(1) Discussion on Mr. R. W. Mann's paper on "The Enfranchisement of Urban Leases." (2) Mr. H. Martin on "Recent Proposals for Leasehold Enfranchisement." 8 p.m.

*Leeds and Yorkshire Architectural Society.*—Mr. Samuel Vyle on "Lightning Conductors."

*Edinburgh Architectural Association.*—Mr. H. H. Gunn on "Geology in its Relation to Architecture." 8.30 p.m.

*Society of Arts (Cantor Lectures).*—Dr. G. V. Poore on "Climate and its Relation to Health." (III. "The Chief Sources of Atmospheric Impurities.") 8 p.m.

*Inventors' Institute.* 8 p.m.

TUESDAY, JAN. 27.

*Institution of Civil Engineers.*—(1) Discussion on Mr. Hamilton-Smythe's paper on "A Comparison of British and Metric Measures for Engineering Purposes." (2) Mr. D. S. Smart on "The Modern Practice in the Design and Construction of Steam Boilers." 8 p.m.

WEDNESDAY, JAN. 28.

*Society of Arts.*—Mr. R. Brudenell Carter, F.R.C.S., on "The Influence of Civilisation upon Eyesight." 8 p.m.

*Civil and Mechanical Engineers' Society.*—Mr. R. Nelson Boyd on "The Petroleum Fields of Europe." 7.30 p.m.

THURSDAY, JAN. 29.

*Institution of Mechanical Engineers.*—Annual Meeting. Five papers to be read, including one by Mr. George Richards "On Recent Improvements in Wood-Cutting Machinery." 7 p.m.

*Society of Antiquaries.*—8.30 p.m.

*Parkes Museum.*—Mr. James Cantlie, F.R.C.S., on "Degeneration amongst Londoners." 8 p.m.

*Society of Arts (Howard Lectures).*—Mr. W. Anderson on "The Conversion of Heat into Useful Work." V. 8 p.m.

*York Arts Guild.*—Mr. B. Priestley Shires on "The Domestic Life of the Edwardian Period, as shown by its Architecture." 7.30 p.m.

FRIDAY, JAN. 30.

*Institution of Civil Engineers.*—(*Students' Meeting*).—Mr. F. W. Stokes on "The Iron Bridges on the Hull, Barnsley, and West Riding Junction Railway." 7.30 p.m.

*Institution of Mechanical Engineers.*—Annual Meeting continued. 7 p.m.

## Miscellanea.

**The Cause of Soot-Clouds.**—Stripped of its technicalities, and reduced to the common-sense level of average human brain-power, the discussion about soot and fuel economisers amounts to this: We want less of force and rapidity and more of volume in the air passing through our domestic fireplaces. They ought not to be so much like small blast-furnaces as they too generally are. The fuel, whatever it be, should burn quietly, consuming the combustible part of the fuel, allowing the gases,—which are partly waste, unfortunately, and partly consumed,—to rise slowly and passively, and escape up the chimney without blowing up the residue of the carbon with them. A strong and rapid current of air through a fire must mean waste, and most probably will also mean soot or smoke. The air which supplies oxygen to a fire should be wafted gently between and over the coals in the grate, not blown with a rush from below through them. If this simple fact be mastered, it will be easy to secure the object with almost any grate and any fuel. If it be not understood, the search for a special apparatus and particularly good fuel must be futile. Let us begin by first learning and then teaching the A B C of the process, which is really very simple if it be only understood. As it is, the cloud of words is becoming almost as great a nuisance as the soot-cloud itself.—*Lancet.*

**New Peabody Buildings at the West End.**—The Peabody Trustees have just erected another range of buildings for the industrial classes, which are intended to be thrown open for occupation during the ensuing week. The buildings are situated on the west side of Little Coram-street, and have been erected on the Foundling estate, covering an area of about 15,000 superficial feet. They consist of eight double blocks, and have been built on the east, west, north, and south sides of the site respectively, around a spacious open area and recreation-ground, about 220 ft. in length and 120 ft. in width. Each block has its separate entrance in the open area, the whole of the blocks being approached through two gateways in the Little Coram-street frontage, which is upwards of 300 ft. long, occupying nearly the whole of the west side of the street. The several blocks contain five floors, at the top of each of which there are washhouses, fitted with coppers and every other requisite for their intended purpose. There are kitchen-ranges and register stoves in the different rooms in each block, with convenient fittings for domestic purposes. On each landing there are two water-closets, two main water-taps, and dust-bin. Like the rest of the buildings belonging to the Peabody Trustees, they are faced with stock brick, and stone facings, dressings, and entrances. They have been erected under the superintendence of Mr. H. A. Darbishire, architect to the trustees, Messrs. Cubitt & Co. being the contractors. The apartments on the different floors are arranged in one, two, and three rooms, according to the requirements of families. Six of the blocks are arranged to accommodate twenty-six families each, and the remaining two blocks twenty-four and twenty-five families each, the whole of the blocks being estimated to accommodate a population of about 1,000 persons.

**The Continued Enlargement of the Waterloo Station.**—During the present week another step has been taken in connexion with the enlargement of the London and South-Western Railway Company's Waterloo terminus, which has been in progress for upwards of four years, and which is now the largest passenger railway station in the metropolis, covering an area of something like twenty-five acres. The new roof to the station, as enlarged on the north side for the Windsor traffic, has just been completed, and this portion of the extended station is shortly to be opened for traffic. The enlargement is, however, about to be effected to a considerable length further northwards, extending to the York-road boundary; and with this view Messrs. Perry & Co., the company's contractors, are at present engaged in the construction of a series of arches on the large area of vacant land extending westward from the recently-erected offices off York-road, to Griffin-street, and northward from the new Windsor Station, just completed, to York-road, along which a retaining-wall, has just been erected. Parallel with this retaining wall, in the direction of Waterloo-road, a number of houses and shops, which the company purchased some time ago, are this week being taken down and on the site thus cleared a new block of offices will shortly be erected, in continuation of those which were recently built, the lower portion of which is now occupied by the Government for Parcels Post purposes, and the upper floors for the engineer's and other departments in the company's service.

**"Climate in its Relation to Health."**—Dr. Poore delivered his second lecture on this subject at the Society of Arts, on Monday evening. He began by alluding to the fact that the crew of the *Eira* enjoyed excellent health in the Arctic regions under conditions which, in this country, or still more in the tropical countries, would be considered most mal-hygienic. The reason probably was that in the Arctic regions putrefaction and allied changes were impossible, owing to the cold and dryness, and the diseases dependent on putrefaction were also impossible. Attention was drawn to the fact that most of the diseases which were fatal in tropical countries were connected with putrefaction and decay, and as instances of this, malarious diseases, yellow fever, and cholera, were brought forward. Since putrefaction depended upon the access of minute organisms to the putrescible matter, and since these organisms were found in the atmosphere as well as in the soil and water, a study of the floating matter in the air became most important.

**Royal Meteorological Society.**—The annual general meeting of this Society was held on Wednesday evening, the 21st instant, at the Institution of Civil Engineers, Mr. R. H. Scott, F.R.S., President, in the chair. The secretary read the report of the Council, which showed the Society to be in a very satisfactory condition. The council have appointed committees to investigate the subjects of the brilliant sunrises and sunsets of 1883–4, and of the local phenomenon known as the Helm Wind of Cross Fell, Cumberland. The observing stations of the society now number eighty-five, the results from which are printed in the *Meteorological Record*. The whole of the stations in the south of England have been inspected during the year and found to be generally in a satisfactory state. The number of Fellows on the roll of the Society is 552, of whom 37 were elected in 1884. The President, Mr. R. H. Scott, then delivered his address, in which he treated of the general state of the science of meteorology over the globe, as compared with the programme sketched out by Prof. Jas. Forbes in the Report of the British Association, 1840. He said there were now six meteorological societies publishing journals, and in addition six periodicals almost exclusively devoted to the science. He went on to say, with all this wealth of literature there is one particular in which, in this country at least, our science labours under a great disadvantage. So far as he was aware, no instruction is given in it, except at the Royal Naval College, Greenwich. The officers and council for the ensuing year were then elected, Mr. R. H. Scott being re-elected president.

**Labour and Wages in America.**—This was the subject of a paper read by Mr. D. Pidgeon before the Society of Arts on Wednesday evening last. The author first drew attention to the radical differences which distinguish native American from alien labour, exemplifying the high condition of the former by the Lowell of forty years ago, as described by Dickens, Miss Martineau, and others. He then sketched the social life of certain existing industrial towns, the "fastnesses" to which native American labour has, so to speak, been driven by immigrant operatives, who have imported into the States the lower life conditions exhibited by their class in Europe. After considering the efforts which are now being made in America by the State, and by individuals, to raise the status of alien labour to the levels of the past, he concluded that it was doubtful whether or not it is now rising or sinking in the social balance. Passing next to economic considerations, he stated what wages are now being paid to factory operatives in the States, their relation to the cost of subsistence, and to wages and cost of subsistence in this country, concluding that while an English mechanic might vastly better his social condition by residence in the States, he would probably find himself little richer, in money, after paying the enhanced prices for subsistence, and conforming to the higher standard of life prevalent in America.

**Ventilation of the Law Courts.**—The following paragraph appeared in some of the daily papers on Wednesday:—"Mr. Baron Huddleston, while trying a case in one of the courts of the Queen's Bench Division yesterday, complained seriously of the defective ventilation and of the draughts, in consequence of which his Lordship and others were suffering. The learned Judge requested that the engineer should be called before him, and when the engineer presented himself, ordered, by way of protest against the new-fangled system of ventilation, that the gratings through which the draughts came should at once be pasted up, remarking that if the consequence was to throw the whole system out of gear he should be very glad, as there was something in it that was radically wrong and must be remedied. The engineer promised to carry the order into effect, and at once proceeded to do so." The learned Judge may have been right; but it seems rather a questionable precedent that the efficacy of a system of ventilation of a court should be thus decided on according to the feelings of the presiding judge at the moment.

**Liverpool Engineering Society.**—At the ordinary meeting of this society, held on the 14th inst., at the Royal Institution, Colquitt-street, a paper was read by Mr. Ludwig Benjamin, M.I.N.A., on "The different rules in use for ships' calculations."

**Manchester Architectural Association.** At a meeting of this association, on Tuesday, January 20th, in the old Town-hall, King-street, Mr. John Brooke, A.R.I.B.A., read an interesting account of a ten days' tour in Belgium, illustrated by a number of drawings and sketches. Having described the most interesting features of Antwerp, he observed that Malines was remarkable for its old houses, with their gables and dormer windows executed in the fifteenth and sixteenth centuries. After some remarks on Brussels and Louvain, Mr. Brooke said he particularly noted the thorough construction and honest building of the modern house at Liège. He thought the colour effect of stone and brick at Bruges remarkable; this town contained many interesting churches, and some excellent domestic work. Finally, he visited Ghent. He thought that quaint spires, stepped gables, and flat façades formed the chief characteristics of the Belgian towns. Mr. T. Chadwick, A.R.I.B.A., thought that the study of Belgian architecture had already produced marked results on buildings designed by many leading English architects of the day, and would do more so in the future.

**Obituary.**—We announce with regret the death of Mr. Stephen Hayworth, builder and contractor, at his residence, No. 108, High-street, Kingsland, on the 11th inst., in his fifty-sixth year. He was well known in the north and east of London, where he had the control of some important estates. He had been extensively employed by the Governors of the Licensed Victuallers' Asylum, in maintaining the repairs of their Institution, covering six acres of land, and consisting of 170 houses and other buildings in the Old Kent-road, for the last fifteen years. Mr. Hayworth was, at the time of his demise, Churchwarden of West Hackney Church, and on Saturday last, the 17th inst., a choral service was performed there on the occasion of the funeral, after which the coffin was conveyed to Abney Park Cemetery for interment. Many of the foremen and workmen of the deceased attended and paid a last tribute of respect at the grave.

**Lectures on Sculpture and Architecture at the Royal Academy.** — The following lectures are arranged for delivery.—*Sculpture:* "The School of Praxiteles," by Prof. C. T. Newton, Feb. 16 and Feb. 23; "Medals," by Mr. R. Stuart Poole, Feb. 18; "Pisano as a Medallist," by Mr. R. S. Poole, Feb. 25; "Imitation as the Means, not the End of Art," by Mr. Hamo Thornycroft, A.R.A., Feb. 19; "Bronze Casting as Applied to Sculpture," by Mr. J. E. Boehm, R.A., Feb. 26.—*Architecture:* "The Cairene House," by Mr. R. Stuart Poole, Feb. 11; "Some Principles of Ancient Architecture and their Application to the Modern Practice of the Art," by Mr. G. F. Bodley, A.R.A., Feb. 20; "Greek Architecture," by Mr. F. C. Penrose, Feb. 27; "Staircases," by Mr. G. Aitchison, A.R.A., March 2 and March 6; "Westminster Abbey," by Mr. A. Waterhouse, A.R.A., March 4.

**School and Church Furniture.**—Messrs. Wake & Dean, who have been established in Southwark since the commencement of the present century, have lately opened a show-room at 111, London-road, adjoining their steam factory in Bath-street. The "Southwark" Convertible Desk, capable of being used (1) as a desk and seat for school use, (2) as a backed seat, and (3) as a table and seat, is a very good thing of its kind, as may be to some extent inferred from the statement that over 100,000 of them have been sold. The "Borough" School Board Dual Desk, desks and tables for Kindergarten teaching, and masters' and mistresses' desks and tables, of special design and construction, are among the many other school appliances exhibited in great variety in the show-room, all characterised by excellence of material and workmanship.

**The Bicycle Show on the Thames Embankment.** — Messrs. Piggott Bros., of Bishopsgate, are erecting a large marquee on the vacant ground adjoining the Thames Embankment, until lately belonging to the Corporation, for the Bicycle and Tricycle Show which is to be held during the ensuing week, commencing on Wednesday next and continuing until Saturday. The marquee is 400 ft. long, extending from Tudor-street, southwards, to the Embankment boundary. It is 40 ft. in width, thus containing a ground area of 16,000 ft. The contractors are laying down a strong boarded floor, and providing facilities for bicycle and tricycle displays during the time of the Exhibition.

**The Ancient Church of St. Helen, Cliffe-at-Hoo,** near Rochester, one of the most interesting in England, as the scene of the seven Saxon Councils of Cloveshoo, between A.D. 742 and 824, was re-opened, after restoration, on January 7th. The contract has been divided into six sections, the first of which is now complete. The flat roofs and plaster ceilings have been removed and replaced by high-pitched roofs. The portion over the chancel is of English oak, elaborately carved. In taking down the semicircular brick east window of 1732, sufficient remains were discovered to reproduce the magnificent Decorated window, erected in 1350 whilst Archbishop Whittlesey was rector of Cliffe. Many of the old members have been re-used, and the entire east gable has been rebuilt of coursed bands of flint and stone, from the old material found in the *débris*. The new roof to the north aisle forms the second contract, and is now in course of erection. Mr. Alderman Naylar, of Rochester, is the contractor, and Mr. V. Hibbins clerk of the works. The carving has been executed by Mr. Thomas Earp. The whole of the work is being carried out from the designs and under the superintendence of the architects, Messrs. Romaine-Walker & Tanner, of 19, Buckingham-street, Adelphi, W.C.

**Provident Institution of Builders' Foremen and Clerks of Works.** — The annual meeting for the election of officers, &c., was held at the Office, 9, Conduit-street, on Wednesday evening last, Mr. Cockrane in the chair. Among the other members present were Messrs. Court, Groome, Welch, Heathcote, Fraser, Brodie, Perrott, Lister, Brown, Elder, Bennett, Merrifield, Goodwin, Mead, Hailes, Tookey, West, Ross, Turner, and Stapleton. The minutes of the previous meeting having been read, the decease was announced of Mrs. Burnell, who had been a pensioner (as the widow of a deceased member) for the long period of twenty-nine years. Among the letters read by the corresponding secretary (Mr. J. W. H. Bedford), was one from Messrs. Wilcocke & Co., of Burmantofts, Leeds, enclosing a cheque for 5*l.* as a donation to the funds of the Institution. The meeting then proceeded to the election of officers, Mr. George Plucknett, J.P., being unanimously re-elected as Governor. The retiring Directors were Messrs. Bune, Heathcote, and Stapleton. Mr. Stapleton was re-elected, and Messrs. Mead & Fraser were appointed to fill the other vacancies. The following officers were re-elected, viz., Mr. J. Welch, Treasurer; Mr. G. Ross, Librarian; Mr. J. Derry, Financial Secretary; and Mr. J. W. H. Bedford, Corresponding Secretary. Mr. Thomas Lister was elected Vice-President; and Mr. T. H. Court, President. Mr. Derry, the Financial Secretary, presented a statement showing that during the past year the sum of 236*l.* had been paid in pensions to the widows or orphans of deceased members and towards the relief of afflicted members. It has been arranged to hold the annual dinner at the Holborn Restaurant on Saturday, Feb. 28. The Institution was established in 1842, and has done much useful work.

**Society for the Encouragement of the Fine Arts.**—At the first *conversazione* of this society, held in the new art-galleries in Piccadilly, on the 15th inst., a handsomely illuminated testimonial, signed by Sir John Ellis, bart., and the Council, was presented to the Chairman, Mr. James Edmeston, in recognition of his services in promoting the objects of the Society. Mr. Cave Thomas, the deputy-chairman, presented the address, accompanying the presentation by some remarks on the duties which the City of London, as a great commercial centre, owed to art, and the benefit which it should derive from the promotion of art, especially of monumental painting.

## COMPETITIONS, CONTRACTS, & PUBLIC APPOINTMENTS.

*Epitome of Advertisements in this Number.*

### COMPETITIONS.

| Nature of Work. | By whom required. | Premium. | Designs to be delivered. | Page. |
|---|---|---|---|---|
| Town-hall Alterations | Borough of Brecon Town Council | 20*l.* | Feb. 9th | i. |

### CONTRACTS.

| Nature of Work, or Materials. | By whom required. | Architect, Surveyor, or Engineer. | Tenders to be delivered. | Page. |
|---|---|---|---|---|
| Execution of Works | Hackney Board of Wks | J. Lovegrove | Jan. 28th | ii. |
| Supply and Execution of Articles and Works for Twelve Months | Vestry of the Parish of Chelsea | G. R. Strachan | Jan. 29th | xviii. |
| New Boiler, &c. for the Steamer *Marguerite* | Met. Asylums Board | W. R. Oswald | Jan. 30th | ii. |
| Day and Jobbing Works, &c. | Vestry of the Parish of Paddington | *Official* | Feb. 2nd | ii. |
| Pulling-down Building | Vestry of the Parish of Chelsea | do. | Feb. 3rd | xviii. |
| New Boiler for the Steamer *Albert Victor* | Met. Asylums Board | J. W. Peggs | do. | ii. |
| Works and Materials | Vestry, Parish of St. John, Hampstead | C. H. Lowe | Feb. 4th | xiii. |
| Kerb and Tar-Paving | Chiswick Local Board | Mr. Ramsden | do. | xiii. |
| Iron Railing | do. | do. | do. | xiii. |
| Road-making and Paving Works | Fulham Board of Wks | *Official* | do. | ii. |
| Erection of School and Teacher's Residence | Dagenham School Brd. | Jno. Hudson | do. | xiii. |
| Excavating, &c., Beulah Park Estate | Not stated | W. Newton Dunn | do. | ii. |
| Brick Sewers | Met. Board of Works | *Official* | Feb. 5th | ii. |
| Sewerage Works; Machinery | Wednesbury Local Brd. | E. Pritchard | do. | xviii. |
| Ironwork for Bridges, Brooksby | Midland Railway Co. | A. A. Langley | Feb. 6th | ii. |
| Ironwork for Bridges, Bredon | do. | do. | do. | ii. |
| Ironwork for Bridges, Croxall | do. | do. | do. | ii. |
| Repairs, &c., to Premises, Whitecross-street | do. | do. | do. | ii. |
| Male Lunatic Wards at the Workhouse, Poland-street, W. | Guardians of the Poor, Westminster Union | H. Saxon Snell & Sons | do. | ii. |
| Fitting-up and Putting to Work Machinery, and Engineer's Work | Commissionrs of Public Baths, &c., Bermndsy | G. Elkington & Son | do. | ii. |
| Wrought-Iron Lattice Girder Highway Bridge, &c. | Property Com., King's Lynn Corporation | E. G. Mawbey | Feb. 7th | ii. |
| Making Roads and Paths, &c. | Grdns. of the Croydon Union | Berney & Monday | Feb. 9th | xviii. |
| Building Works | Com. of Pub. Baths, &c., St. Mary, Whitechapel | J. Hudson | do. | ii. |
| Road Materials | Com. of H.M. Works | *Official* | do. | i. |
| Erection of Engine and Boiler, Houses, Chimney-Shaft, &c. | Proprietors of Barton Mills, Canterbury | J. G. Hall | Feb. 11th | ii. |
| Bricklayer, Mason, Carpenter's, &c., work, Darlington | North Eastern Railway | W. Bell | Feb. 18th | ii. |
| Corporation Sewage Works | Bedford U. S. A. | J. Lund | Feb. 24th | ii. |

### PUBLIC APPOINTMENTS.

| Nature of Appointment. | By whom Advertised. | Salary. | Applications to be in. | Page. |
|---|---|---|---|---|
| County Surveyor | Norfolk | 500*l.* | Jan. 31st | xvi. |
| Surveyor and Inspector of Nuisances | Shepton Mallet Local Bd | 100*l.* | Feb. 2nd | xvi. |

## TENDERS.

For rebuilding bank for Messrs. Cox & Co., Craig's-court, Charing-cross, S.W. Mr. Ewan Christian, architect. Messrs. Vinall & Kennedy, surveyors:—

| | | | |
|---|---|---|---|
| Nightingale | £29,877 | 0 | 0 |
| Dove Bros. | 29,240 | 0 | 0 |
| Patrick & Son | 28,700 | 0 | 0 |
| Manley | 27,922 | 0 | 0 |
| Bird | 27,830 | 0 | 0 |
| Bywaters | 27,683 | 0 | 0 |
| G. Shaw | 27,650 | 0 | 0 |
| L. & R. Roberts | 27,516 | 0 | 0 |
| Holland & Hannen | 27,304 | 0 | 0 |
| Ashby Bros. | 27,132 | 0 | 0 |
| Peto Bros. | 27,110 | 0 | 0 |
| Brass & Son | 26,393 | 0 | 0 |

For alterations and additions at the Red Lion public-house, Walham-green, S.W., for Mr. J. H. Squires. Mr. H. J. Newton, architect, 17, Queen Anne's-gate, Westminster:—

| | | | |
|---|---|---|---|
| Lamble | £1,345 | 0 | 0 |
| Godden | 1,299 | 0 | 0 |
| Cook | 1,083 | 0 | 0 |
| Walker | 1,068 | 0 | 0 |
| Burman & Son | 1,057 | 0 | 0 |
| Gibbs & Flew (accepted) | 900 | 0 | 0 |

For additional reservoir, filter-beds, &c., at Bedford, for the Bedford Town Council, acting as the Bedford Urban Sanitary Authority. Mr. John Lund, engineer. Quantities supplied:—

*Whole Tenders.*

| | | | |
|---|---|---|---|
| S. Foster, Kempston | £4,984 | 0 | 0 |
| T. Laughton, Bedford | 4,664 | 2 | 11 |
| Bottoms Bros., Battersea | 4,620 | 3 | 0 |
| Ambrose & Son, Bath | 4,235 | 0 | 9 |
| Cowdery & Sons, Newent, Gloucestershire | 4,137 | 4 | 6 |
| J. Dickson, St. Alban's | 4,050 | 0 | 0 |
| Cook & Co., Battersea | 3,945 | 10 | 6 |
| Clayson & Sons, Cookhoe, near Northampton | 3,758 | 0 | 0 |
| Pilling & Co., Manchester | 3,750 | 0 | 0 |
| B. Ward, Leicester | 3,721 | 0 | 0 |
| E. Twelvetrees, Biggleswade | 3,635 | 0 | 0 |
| J. P. White, Bedford | 3,630 | 0 | 0 |

For house in Fowler-road, Forest Gate, Essex, for Mr. J. Sharp. Mr. H. F. Simmonds, architect, Cambridge-heath:—

| | | | |
|---|---|---|---|
| Lipscomb | £448 | 0 | 0 |
| Wood | 413 | 0 | 0 |
| Beale | 389 | 0 | 0 |
| Barton | 354 | 0 | 0 |
| Noble | 340 | 0 | 0 |
| Hughes | 330 | 0 | 0 |
| Pollard | 330 | 0 | 0 |
| Preston | 310 | 0 | 0 |
| Edwards | 290 | 0 | 0 |
| Ling & Needham (accepted) | 270 | 0 | 0 |

For the erection of small villa, for Mr. W. H. Higgins, in Castle-street, Luton. Mr. John R. Brown, architect, Luton:—

| | | | |
|---|---|---|---|
| D. Dunham, Luton | £800 | 0 | 0 |
| A. Batson, Luton | 715 | 0 | 0 |
| S. Redhouse, Stotfold, Baldock | 688 | 0 | 0 |
| Joseph Robinson, Dunstable | 665 | 0 | 0 |
| T. Neville, Luton | 634 | 0 | 0 |

For the erection of six shops in Cheapside, Luton, for Mr. Wiseman. Mr. John R. Brown, architect, Luton:—

| | | | |
|---|---|---|---|
| S. Redhouse, Stotfold | £4,496 | 0 | 0 |
| T. Neville, Luton | 3,716 | 0 | 0 |
| D. Dunham, Luton | 3,700 | 0 | 0 |
| J. Robinson, Dunstable | 3,698 | 0 | 0 |
| Smart Bros., Luton (accepted) | 3,348 | 0 | 0 |

For additions to ironmonger's shop, &c., High-street, Hounslow, for Mr. Ellsley. Mr. J. R. Morgan, architect. No quantities:—

| | | | |
|---|---|---|---|
| Sawyer, Cranford | £348 | 0 | 0 |
| Hogbin, Hounslow | 218 | 0 | 0 |
| Danels, Hounslow (accepted) | 230 | 0 | 0 |
| Billins, Hounslow | 210 | 0 | 0 |

[Architect's estimate, 175*l.*]

For converting three houses at Bowes Park, Woodgreen, into shops, for Mr. Geo. Searle. Mr. D. Taylor, architect and surveyor, New Southgate:—

| | | | |
|---|---|---|---|
| F. Voller | £125 | 0 | 0 |
| Kirby & Chase | 111 | 10 | 0 |
| T. Scarborough (accepted) | 97 | 0 | 0 |

[Surveyor's estimate, 103*l.*]

For the construction of roads and sewers, Penge, for the London and Suburban Land Company, Limited. Messrs. Hammack & Lambert, architects and surveyors:—

| | | | |
|---|---|---|---|
| F. & F. J. Wood | £5,973 | 0 | 0 |
| J. G. Marshall | 4,990 | 0 | 0 |
| J. Cardus | 4,937 | 0 | 0 |
| J. Bloomfield | 4,473 | 0 | 0 |
| P. G. Pound | 4,424 | 0 | 0 |
| R. Mayo | 4,200 | 0 | 0 |

For the erection of an Out-patients' Department and Nurses' Home, for the Victoria Hospital for Children, Queen's-road, Chelsea. Messrs. H. Saxon Snell & Son, architects:—

| | Carcass. | Inside Finishings. | Total. |
|---|---|---|---|
| Nightingale | £3,857 | £3,586 | £7,443 |
| Macey & Co. | 3,647 | 3,583 | 7,230 |
| Mowlem & Co. | 3,383 | 3,621 | 7,004 |
| Chas. Wall | 3,261 | 3,289 | 6,550 |

For general alterations to 7, Newington Butts, and 6, Walworth-road, S.E., for Messrs. Freeman & Winthrop. Mr. Wm. Whiddington, architect, Finsbury-pavement, London, E.C.:—

| | General Works. | Plumbing and Gasfitting. | Total. |
|---|---|---|---|
| Emery | £247 0 0 | £97 15 0 | £344 15 |
| Pritchard | 220 0 0* | 116 0 0 | 336 0 |
| Wood, Harris, & Co. Clapham-road | 252 2 6 | 82 19 6* | 335 2 |

* Accepted.

For additional works in constructing new road and sewers, at the Regent's Park-road Estate, for the Directors of the Birkbeck Freehold Land Society. Mr. Sydney B. Grosvenor, surveyor:—

P. Pound (accepted) ..... £148 11 9

[No competition.]

*SPECIAL NOTICE.*—Lists of Tenders frequently reach us too late for insertion. They should be delivered at our Office, 46, Catherine-street, W.C., *not later than Four p.m.* on THURSDAYS.

## TO CORRESPONDENTS.

E. H.—C. S. M. (received).—T. L. P. (should send amounts).—A. P. (ditto).

All statements of facts lists of tenders, &c., must be accompanied by the name and address of the sender, not necessarily for publication.

We are compelled to decline pointing out books and giving addresses.

NOTE.—The responsibility of signed articles, and papers read a public meetings, rests, of course, with the authors.

*We cannot undertake to return rejected communications.*

Letters or communications (beyond mere news-items) which have been duplicated for other journals, are NOT DESIRED.

All communications regarding literary and artistic matters should be addressed to THE EDITOR; all communications relating to advertisements and other exclusively business matters should be addressed to THE PUBLISHER, and *not* to the Editor.

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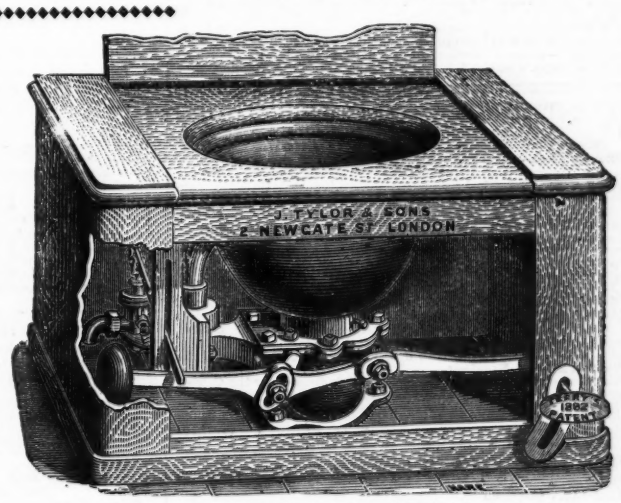

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